Load Dispatching Practice of the New England Power Company—*Use of Iron and Steel Wire for Transmission Line Conductors and other engineering articles dealing with station and operating practice.*

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Electrical World

New York, October 14, 1916 McGraw Publishing Co., Inc. Vol. 68, No. 16 10c a copy

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TO OBTAIN the high incandescence necessary for the Type "C" (gas-filled) lamp, the filament must be kept so near the melting point that a line surge of any considerable consequence destroys the lamp. The Regent Socket uses a perfectly calibrated film which punctures uniformly and accurately at rated voltage, thus allowing the circuit to re-establish itself instantly when one lamp has burned out. Line surges which result from the use of imperfect films are eliminated. The lamp life is greatly increased. Lamp renewal and trouble "shooting" expense are reduced to a minimum. The fixture cost is saved in a short time.

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At first many of the foremost electricians, electrical engineers and other scientific men were skeptical of the real and permanent value of these Instruments, and many ridiculed the claims made for them, some going so far as to pronounce them valueless.

Gradually, however, the real value of the Instruments began to be recognized; their sale and use in this and foreign countries steadily increased, until it became a recognized fact that these Instruments constituted a contribution of incalculable value to the art of electrical measurement.

Their introduction and use gave an impetus to the development of each of the numerous branches of the electrical industry that was most marked, and that was not before possible.

In fact, these Instruments virtually created the art of practical measurement and provided a new and powerful means of successfully solving many difficult problems.

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During the 28 years since the introduction of the Weston Permanent Magnet Moving Coil Instruments no substitute has been found for them. Wherever electrical energy in the form of direct currents is employed, Weston Instruments of this type, or imitations of them, are used.

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The Weston Reputation, therefore, is an established fact. However, it does not rest alone upon this particular contribution to the art of electrical measurement, for numerous other equally important contributions to that art have been made by the Weston Company.

The Weston Name, its reputation now firmly established, is in itself an endorsement of each Instrument that bears it.

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Electrical World

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Bridging Science and Engineering

AN impressive example of what engineers and scientists may together accomplish is presented in the formation of a National Research Council. More specifically this amalgamation of purpose of the National Academy of Science and our engineering societies in a plan to promote the cause of research in the United States and to place research at the disposal of our government, is an illustration of the practical value of the Engineering Foundation as a working organization to make such a plan possible. Behind the simple announcement of a splendid purpose is the thought and work of men who have visualized the future and then made a practical plan for realizing their visions. We congratulate the officers of the National Academy of Science and of the Engineering Societies Foundation for their vision and their aim.

We have had occasion to say that scientific research work in this country has not been correctly related to engineering and industrial advance. As John J. Carty stated in his address when retiring as president of the American Institute of Electrical Engineers, there are two classes of research: one, comprising investigations in pure science and properly carried on for the free advancement of all science; two, industrial research, properly conceived on a commercial basis and developed primarily for the benefit of a private group. Mr. Carty's clear distinction will help settle many disputes as to the relations of research work and commercial advance.

It has not been so clear how the gap between science and research can be bridged; how the findings of the scientist, on the one hand, can be made available to the industrial research worker; and how, on the other, the problems of the industrial worker can be massed in such a form as to give a sense of direction to the pure scientist. The proposed plan by which the National Academy of Science and the four great engineering societies will work for a common cause should eventually open avenues for the interchange of thought and opinion which will be of real service.

In this interchange between science and industrial and applied engineering research, the technical and engineering journals of this nation have a function which they have often performed in the past, and which is constantly widening in opportunity as the walls of reserve and tradition between science and applied engineering are broken down. They act as the interpreters of the accomplishments of science to the applied engineers and of the needs of their industries to the scientist. The alignment of science and engineering which has been accomplished marks, therefore, an epoch in the better understanding of the forces at work in our scientific and industrial advance in this country. Deeply, as never before, our nation feels the need of research work. Psychologically, this is the time to promote the cause of research. We see tremendous and far-reaching possibilities of accomplishment for the new formed National Research Council.

The Industrial Outlook

PRESIDENT HENRY of the American Electric Railway Association takes what is perhaps a pardonable but nevertheless cheerless view of present-day conditions. In addressing the annual convention of that association in Atlantic City this week he said: "Prices of all commodities, products of the farm and workshop have increased to such an extent as could not have been anticipated in a country not in actual war. Speculation of all kinds has been stimulated, and a quiet people who have heretofore always been content with ordinary business conditions have been carried away into the whirlpool. Usual every-day business has become insipid, and nothing in a business way that does not promise quick returns and immense profits seems to satisfy. Employment under ordinary conditions and at even reasonable advanced wages is by the workmen looked upon with contempt. The whole industrial body has become restless and dissatisfied."

Now, while it is true that the war has brought with it feverish production, inflated profits, business intoxication and industrial unrest, it has not been without benefit to the electrical industry as a whole. The electric railways of the country, to be sure, have not been prosperous for some years, but they will not always remain in that condition. Indeed, a change for the better has already set in. The prosperity of the rest of the industry is everywhere apparent; manufacturers are oversold and central stations are piling up heavier loads.

There probably will be a rearrangement following the signing of a treaty of peace, but there will be little dropping off of business for some time to come, if at all. It will be natural for manufacturers and central station managers to endeavor to hold up production and output, and an industry so young, impetuous and enthusiastic will have no difficulty in measuring up to expectations. If, moreover, as has been hinted, competition with more efficient nations ensues after the war, that will only serve to make greater demands on the electrical industry, because electricity is the handmaid of efficiency. Increased or more economical production of manufactures will only mean wider and more intensive

applications of electricity. We have, therefore, every reason for feeling optimistic and not pessimistic.

Water Heating by Electricity

NO discussion of cooking by electricity is complete without some reference to hot-water heating. While electric cooking at a reasonable rate for current is now past the experimental stage and fairly launched on a sound commercial basis, the problem of furnishing hot water to the home in which the electric range is used is not solved. As one speaker stated in substance during the discussion at the meeting of the electric range committee of the National Electric Light Association in Chicago, "the best electric water heater on the market is the coal stove. The Almighty apparently didn't put calories enough into each kilowatt to make electric water heating feasible." While this statement is hardly scientific, it sometimes seems exasperatingly true as a practical matter, and the amount of electricity necessary to raise "one pound of water one degree" is not generally recognized until it is tried. The amount of heat that a quart of water will absorb and still remain cold is astounding. It is, therefore, with particular interest that we call attention to an abstract of an article descriptive of European practice in electric water heating in this week's Digest. Thermal storage systems, which the author advocates, have been considered in this country, and the results of the experiments will interest every central station manager, manufacturer and designing engineer who has been looking for the best method of heating water by electricity.

Characteristics of Iron and Steel Conductors

MAINLY as a consequence of the world war, the price of copper has risen to a point at which it often becomes desirable to consider the relative merits of copper and steel in special cases of the transmission and distribution of electric power. From a mechanical standpoint, the advantage is all on the side of steel. From the standpoints of conductivity and durability, the advantages are on the side of copper. In direct-current circuits, the relative economical advantages are determinable without difficulty, but in alternating-current circuits, the question is complicated by the extra resistance of skin effect. The skin-effect resistance of a steel conductor depends upon the diameter of the wire, as well as on its lay, if stranded, and on the electric conductivity and magnetic permeability of the steel. The effective permeability varies with the current strength, and it is the circular, not the longitudinal, permeability that counts. The result is that experimental measurements are needed in order to determine the skin-effect resistance of a given sample of steel wire at a given temperature and current strength.

The article on page 760 of this issue by Messrs. C. K. Oakes and W. Eckley discusses some experimental observations on steel conductors at 60 cycles per second and at 20 deg. C. It will be seen that seven-strand 5/16-in. Siemens-Martin steel cable showed only a small increase in resistance due to skin effect up to 35 amp. On the other hand, No. 6 B. W. G. solid galvanized-iron wire showed a skin-effect resistance ratio of 2-1, or 110 per cent extra resistance, at 13 amp. The kind of steel that is desirable for such purposes should have high electric conductivity, low hysteresis loss, and low magnetic permeability, while possessing ample mechanical strength. The soft irons are usually poor a.c. material on account of their high permeability. The hard steels are ordinarily better. The general results indicate that, for small loads, steel wires may be distinctly economical, especially if the load is not likely to increase, and the service may not last many years. As is pointed out in the article, however, it is not easy to lay down any general rule in the matter, and each case must be treated on its own merits.

Expansion and Concentration Ahead

ALL parts of the electrical industry have not had an equal measure of prosperity. In some of the newer holding companies earnings have improved much more slowly than has been the case with the large established properties in the great centers of population. The difficulties which confronted some of the holding companies two years ago have been largely overcome, however, and there is now a marked change for the better in both current business and future prospects. Like the individual operating properties, the holding companies have been able to finance maturing obligations and new capital requirements on terms that substantially brighten their outlook. With the country "growing up" to the newer group of holding companies it is interesting to consider what other developments may be seen in concentration of ownership. Existing holding companies have purchased few additional properties recently. This is due primarily to the fact that prices of remaining available properties are not generally regarded as inviting under present conditions. Precedent shows, however, that even when prices are high, investment may be started by bankers who feel justified by future prospects. Such buying may be directed toward properties that will enlarge or round out existing holding companies or toward the formation of entirely new groups. The merger of properties capable of physical union is a natural form of concentration which has not been fully developed, and further progress in this direction is so plainly warranted on economic grounds that it will undoubtedly continue.

Lighting Rates for Dry Goods Stores

A NEW school of philosophers has made its appearance. By a process of reasoning, plausible though fallacious, the National Retail Dry Goods Association hopes to convince the central stations of the country of the errors of their ways and effect material savings for its members. Whether or not the organization is merely following the fashion of the day or has discovered a

vulnerable point, in central station rate making, we cannot say. At any rate, it has many adherents, and it behooves central station managers to watch its work. Last week we published an account of an inquiry as to the rates paid by dry goods stores being made by the National Retail Dry Goods Association. That body believes that since ours is a comparatively new industry, it is not surprising that rates have not as yet been standardized. Ninety-six stores in various sections of the country were cited, and the inference is that the association will work for a uniform rate for electrical energy. No consideration is given to the cost of service or character of the load, and it would be just as sensible for the association to collect data on the rents paid by various stores throughout the country and argue therefrom for a uniform rental per square foot of area. The move, however, shows that central station rates are being subjected to scrutiny from responsible business sources, and indicates that the whole subject of rates for central station service must be placed on a sure and permanent foundation if it is not to be assailed successfully.

Service from a Transmission Network

THE electric transmission system of to-day is an intricate affair. When extensive it rarely depends on a single generating station, and usually consists of a more or less complicated network fed by from two or three to a dozen or more plants containing hydraulic or steam prime movers. A problem therefore arises in making all the stations pull together to the greatest possible advantage. It is no longer a case of feeding a single line from a single station, but of feeding many lines from a carefully organized group in such a manner as to obtain the utmost reliability of service together with the fullest possible utilization of the hydraulic power which is available.

The care with which the control of the operation of such a network is worked out is well illustrated in the practice of the New England Power Company described elsewhere in this issue. This company operates a distributing system served by a group of hydraulic plants. The general method of linking the plants together is made clear in the article. Several features are worthy of special mention.

Millbury, Mass., is the working center of the complete network, and here is located the switching station for all the important high-tension lines. From this point the handling of each generating station and substation is directed, complete records being kept of all operations, and special attention paid to making the best use of the hudraulic conditions which may from time to time exist. An unusual feature of this hydraulic control is a rather complete system of gaging stations for measuring the flow of the stream and the rainfall. These stations cover the Deerfield valley above the company's plants and the Connecticut valley from Bellows Falls, Vt., almost to the Canadian border. The Deerfield valley watershed is only about 550 square miles, but the storage capacity is great, and the precipitation fairly high. On this stream the maximum flow comes about thirty hours after a storm, and about two days are required for the water from the storage reservoir to reach the lowest plant. On the Connecticut the storage is comparatively small, only about 1,000,000 kw.-hr., and it takes three days after a storm for the river to reach its highest stage. Full information regarding rainfall, height of the river, and in late winter and spring the temperature, which gives a clue to the probable flow from melting snow, is regularly transmitted to the Millbury control station. It is therefore possible to utilize the aggregate rainfall to the best advantage which the actual hydraulic conditions permit. The Deerfield River furnishes a quick run off with a possibility of large storage near the headwaters. The Connecticut gives a rather slow run off with only moderate storage, which must be utilized in the best way the flow allows.

The equipment of the load dispatcher at Millbury is very complete, with a system diagram showing the switching connections of all oil switches, the transmission lines, and the high-tension system generally. A complete record is kept of all the operating conditions and of all power plants, lines and customers' equipments connected with the system. All operating troubles, too, are handled at the Millbury station, analyzed and recorded, so that the place, origin and cause of every failure may be given continuous record, which greatly facilitates prompt remedial measures. In fact, all the details of operation as regard the production and distribution of load from the main plants of the company and all auxiliaries are here recorded and studied. The summary of the whole situation is reported daily to the office of the general manager of the company at Worcester. We have yet to hear of a more efficient and thoroughly organized dispatching service than the one to which reference is made here.

The Coming Issues

IN the next or engineering number of the ELECTRICAL WORLD for October, a leading article will discuss the design and construction features of an electrically operated Alabama cotton mill and give results of tests to determine the effect of condition, speed and number of driven machines on the power demand. Another article will review the results of an experimental investigation of temperature distribution around a synchronous converter armature. In a third article, Prof. Alexander Gray comments on the output limitations in direct-current machines. The fourth issue of the month, dated Oct. 28 and regularly devoted to broad commercial subjects, will contain a valuable and timely discussion of a proposed co-operative or dividend type of electric service rate designed to promote the use of electrical energy for cooking and water heating. This article will start a series dealing with different phases of this subject. The fourth number of ELECTRICAL MERCHANDISING, the new monthly magazine of the electrical trade, which offers the editorial services of the ELECTRICAL WORLD, is issued under date of Oct. 15.

Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

ENGINEERS TO CO-OPERATE WITH SCIENTISTS

Organize National Research Council to Secure Efficiency in Solution of Problem of Peace and War

Arrangements have just been completed in New York whereby the resources of The Engineering Foundation, under the auspices of the four principal national engineering societies, are placed at the disposal of the National Research Council, which was appointed by the National Academy of Science at the request of President Wilson. The object of the council is to co-ordinate the scientific research work of the country in order to secure efficiency in the solution of the problems of war and peace. The council was without funds until The Engineering Foundation, established to further scientific and engineering research, offered to place its resources at the council's disposal, including the services of its secretary, Dr. Cary T. Hutchinson, to act as secretary of the council. The offer was accepted and plans for immediate activities have been placed in the hands of an executive committee.

In announcing the offer of the Foundation, Chairman Gano Dunn, said that the financial resources amounted to the income of a $200,000 endowment, together with $5,000 additional yearly, both of which represent gifts by Ambrose Swasey of Cleveland. In addition, Cleveland H. Dodge has headed a movement to raise other funds to further the work of the council.

In indicating how thoroughly every branch of science and engineering is represented in the council, Dr. George E. Hale, director of the Mount Wilson Solar Observatory, and chairman of the council, who was in New York last week attending to the details of the arrangement, called attention to the personnel of the body, saying that it is the purpose of the council to enlist the co-operation, in the solution of our industrial and military problems of a scientific character, of every possible established agency. Medicine, for example, is represented on the Council by Dr. William H. Welch, president of the National Acadamy of Science; Brigadier-General William C. Gorgas, surgeon general of the United States Army; Dr. Simon Flexner, director of the Rockefeller Medical Institute, and Dr. Victor C. Vaughan, past-president of the American Medical Society; biological science by Dr. Edwin G. Conklin, professor of zoology, Princeton University; chemistry by Dr. A. A. Noyes of Massachusetts Institute of Technology and Dr. L. H. Baekeland; physics by Dr. A. A. Michelson of the University of Chicago; and electricity by Prof. M. I. Pupin, of Columbia University.

These branches, with the exception of medicine, are in the realm of pure science. Recognizing, however, that the practical applications of the principles which the pure scientists discover rest largely with engineers there is a strong representation from the great engineering societies. John J. Carty, past-president, American Institute of Electrical Engineers and chief engineer of the American Telephone & Telegraph Company; Gano Dunn, president of the J. G. White Engineering Corporation; Clemens Herschel, president of the American Society of Civil Engineers; C. E. Skinner, director of the research laboratory of the Westinghouse Company, and Dr. W. R. Whitney, director of the research laboratory of the General Electric Company are among those who will represent the engineering side of the council's work.

The important military aspects will be presented to the council by Maj.-Gen. William Crozier, chief of ordnance of the U. S. Army, by Lieut.-Col. George O. Squier, chief of aviation of the U. S. Army, and Chief Constructor David W. Taylor, U. S. Navy. Other branches of the government are represented by Dr. S. W. Stratton, director of the National Bureau of Standards; Van H. Manning, director of the Bureau of Mines, and Prof. Charles F. Marvin, chief of the United States Weather Bureau.

The other members of the council are: Dr. John A. Brashear, Pittsburgh; Dr. W. F. M. Goss, dean of engineering, University of Illinois; Dr. William H. Holmes, curator, United States National Museum; Dr. W. W. Keen, president, American Philosophical Society; Prof. E. C. Pickering, director, Harvard College Observatory; Mr. Charles F. Rand, president, United Engineering Society; Prof. Theodore W. Richards, Harvard University; Prof. R. A. Millikan, University of Chicago; Mr. Ambrose Swasey, Cleveland; Dr. Elihu Thomson, Swampscott, Mass.; Dr. C. R. Van Hise, president, American Association for the Advancement of Science; Dr. Charles D. Walcott, secretary, Smithsonian Institution; Dr. J. M. Coulter, professor of botany, Princeton University; Prof. R. H. Chittenden, dean of Sheffield Scientific School, Yale University; Prof. Raymond Pearl, biologist, Maine Experiment Station, Orono, Me.; M. T. Bogert, professor of organic chemistry, Columbia University. Other members of the council will be appointed as the needs of the work dictate.

ELECTRIC RAILWAYS FOR COAST DEFENSE

Military Authorities at Atlantic City Convention Explain How Roads Can Co-operate with Government

On Monday afternoon the annual convention of the American Electric Railway Association opened with sessions of the four affiliated associations. The main association held its opening session on Tuesday morning. At this session Capt. W. K. Wilson of the coast artillery, read a paper on "Coast Defense," and explained that the electric railways extending along the shore could be utilized to advantage in the scheme of coast defense. Lieut.-Col. Chauncey B. Baker, quartermaster's staff, Washington, explained the system of co-operation followed between the steam railroads and the army and recommended a similar arrangement in the case of the electric roads. He suggested the collection of data as to the electric rolling stock and equipment suitable for various military purposes and the changes necessary to make it so suitable. Also the appointment of certain electric railway traffic men to direct military movements over such roads in co-operation with the army in case of necessity.

President C. L. Henry in his annual address briefly sketched the industrial situation in this country brought about by the European war. The electric railways have

felt the injurious effect of the general condition. To prepare for the business conditions after the war Mr. Henry believed that the industrial efficiency of the country should be brought to the highest point. He referred to the success of the association in inducing Congress to exempt electric railways from the provisions of the recently passed eight-hour bill. Taking up the subject of labor and wages, he urged that there should be a duly authorized public body to which employers or employees feeling aggrieved could apply for relief without resort to strikes or lockouts. He said further that there should be legal inhibition of all strikes and lockouts on public service properties.

The attendance was somewhat larger than two years ago when the association met in Atlantic City. The exhibits, however, were not quite so numerous.

JOBBERS TABLE GROUP PLAN

Opposition Develops to Proposal to Divide Membership into Geographical Section

Two hundred leading electrical jobbers and their representatives attended the fall meeting of the Electrical Supply Jobbers' Association held at the Hotel Statler, in Cleveland, Ohio, on Tuesday, Wednesday and Thursday of this week.

Following considerable discussion of the plan to reorganize the jobbers' association into eight geographical groups, each group to hold frequent local meetings in addition to semi-annual national meetings of the general body, it became apparent that in certain sections opposition existed to the proposed redistricting, and after some debate a motion to lay the plan on the table was adopted just before the end of the first day's session.

This grouping proposal which though tabled may again be brought up for reconsideration, contemplated eight geographical divisions, each group to have a chairman and a secretary, who were to submit full reports of all proceedings to the general body.

Following were the geographical groups proposed by the survey committee of the association.

Group 1—Territory including Boston, Rochester, New York City and Newark, N. J. Group 2—Atlanta to Philadelphia. Group 3—Memphis to New Orleans. Group 4—Buffalo, Cleveland, Louisville and Pittsburgh. Group 5—North Central Western cities, including Chicago to Minneapolis. Group 6—Chicago to Omaha, Denver, St. Louis and Memphis. Group 7—Dallas, Houston and Oklahoma City. Group 8—Pacific coast cities.

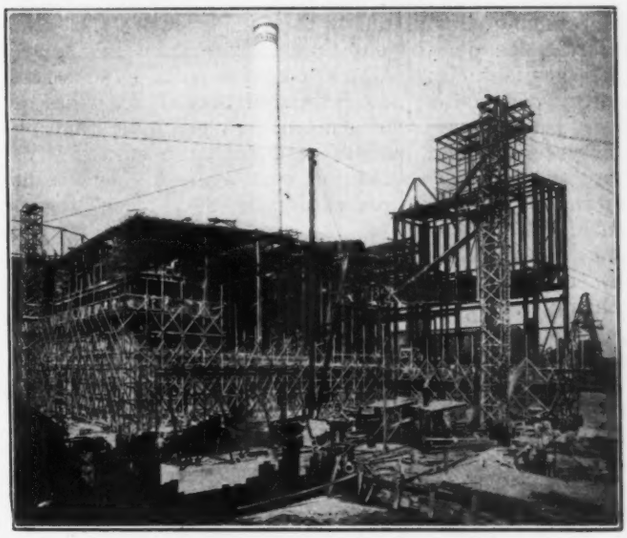
Judge Debevoise in addressing the convention, outlined the operative and legal features of the plan of group organization, and was followed by several members of the survey committee who spoke in favor of the plan, pointing out that it retained the advantages of national organization through the semi-annual meetings, while effecting economies of time and traveling expenses through the local group meetings.

Other speakers insisted that to divide up the present organization would be a step backward. One member objected to the provision to group together remote cities. Others, in the interest of harmony, advised against proceeding with the plan as long as objection remained in any quarter. A proposal to amend the grouping to meet the approval of the central territory members was lost, however, when a motion to place the group plan on the table was passed by a fair majority.

A smoker and lunch were tendered the jobbers on Tuesday evening by the Electrical League of Cleveland in its handsome new rooms on the roof of the Statler Hotel, and Wednesday afternoon was given over to golf at the Shaker Heights Country Club.

New 37,000 Kw. Turbine Plant for New Bedford Company

One of the largest steam turbine plants in New England will be completed during the coming winter by the Stone & Webster Engineering Corporation of Boston, Mass., for the New Bedford (Mass.) Gas & Edison Light Company. The new station, a view of which is shown herewith, will have an initial rating of 37,000 kw. It is located on the Acushnet River in New Bedford, and is designed to handle the company's rapidly growing business in an area considerably transcending the immediate vicinity of the city itself. Under the management of W. H. Snow, the company's load has increased so rapidly within the past two or three years that the existing station on Coffin Street has been outgrown. Large textile establishments offer an attractive power market, and through transmission tie line facilities connecting the plant on Coffin Street with the systems of the Marion Gas Company and the Plymouth Electric Light Company, also including the New Bedford & Onset Street Railway, the company's relations with outside customers have been greatly strengthened.



CONSTRUCTION WORK ON NEW BEDFORD STATION

Lighting and power service on the north side of the Cape Cod Canal are now furnished by the New Bedford company through the Marion company. The new station will enable the operating economies of a centralized generating plant to be realized for efficient distribution far outside the confines of the company's original territory.

The new plant is to be a brick and steel building, 160 ft. by 175 ft. in plan, and having concrete floors and roof. It will contain ten 600-hp. Babcock & Wilcox water-tube boilers, three three-stage turbo-feed pumps, one 15,000-kw., one 10,000-kw. and three 4000-kw. General Electric turbo-generators, seven 1500-kva. outdoor type step-up transformers, Worthington surface condensers, a 50,000-cu. ft. per minute Spray air washer, turbine-driven circulating pumps, a 50-ton Northern electric crane, and other equipment. There will be two reinforced concrete stacks of the superimposed type, a double boiler room, and a coal-handling system provided with a locomotive crane feeding two bucket skip hoists, with a bunker at the end of the building and distribution by motor-driven larry service. There will be one turbo and motor-driven exciter and two turbo-driven exciters, and the switching equipment throughout will be of General Electric type.

An interesting feature of the installation will be the

use of two 4000-kw. turbo sets and four boilers transferred from the old station, this equipment having been placed in commission only about three years ago. Oil switches will be of the remote-control type, and the double-bus system will be provided. The provision of three sizes of generating units will enable the variations in the station load curve to be handled economically. Work was begun on the installation of one 4000-kw. and one 10,000-kw. unit in April, 1916, and commercial power will be delivered from the station during the present month.

Series Lighting Rectifier Problems

In a recent hearing by the Massachusetts Gas & Electric Light Commission in the Boston street lighting arbitration case, L. L. Elden, electrical superintendent of the Boston Edison company, discussed the problem of replacing with big rectifier sets local Brush arc generators driven by direct-connected motors. The city's representative took the ground that in view of the superior operating efficiency of rectifiers as compared with motor-generators for series arc lighting service, the company should employ the former entirely.

Mr. Elden pointed out that an attack on Brush arc machines is one of the most common features of street lighting rate cases, and intimated that if the facts of their use become better known, less misunderstanding will prevail. The witness said that the efficiency of rectifier sets is about 90 per cent against 75 per cent for the Brush motor-generator sets, 80 per cent representing the efficiency of the arc machine and 93 per cent the full-load efficiency of the motor. Rectifiers are now used in all substations supplying Boston street lighting except at L Street and in East Boston.

About two years ago the company investigated the cost of eliminating all its remaining Brush arc generators. A four-year period showed that the yearly operating cost is less by about 17.2 cents per lamp with rectifier sets than with Brush arc machines twelve years of age, excluding fixed charges. Rectifiers cost $2.50 per lamp capacity less than Brush arc motor-generator sets. The two principal items of repair are the tube renewals and the breakdown of transformer coils from lightning or service punctures. It was found that the changes necessary on the street circuits and in the rewiring and rearrangement of the station, including the purchase of additional generating capacity or the alternative installation of rotary condenser equipment to offset the low power factor of the rectifier apparatus would make the change prohibitive in total yearly cost. Despite a saving of possibly $10,000 a year in energy cost, it would not pay under the present conditions.

The witness pointed out that this is a case where good engineering dictates the retention of apparatus which may be said to be going out of vogue, during the balance of its economical life in relation to the rest of the system. In Boston the company has agreed to operate no street lighting circuit from a rectifier above 6000 volts, where joint pole occupancy is involved, although an earlier agreement with other companies permits the full voltage of the Brush machines to be utilized so long as the company does not add to their number. The pulsating current produced by the rectifiers led to greater restrictions on account of its effect on telephone transmission. Mr. Elden stated that as the number of lamps operated from a rectifier increases, the tube life diminishes, and pointed out that if in future a tube life of from 25,000 to 30,000 hours can be secured through improvements by manufacturers, it would pay in most cases to give up the Brush machines, even where there is a well-considered investment.

Committee Activities for America's Electrical Week

For some time the local committees have been making arrangements for the celebration of America's Electrical Week, to be held early in December. Following are some of the activities reported to the Society for Electrical Development for the current week.

Six electrical demonstration shows in various sections of the city will be the center of the week's activities in San Francisco. The largest will be in the nave of the ferry building, and will illustrate the use of electricity upon the farm and in the home.

The street car pageant will pass over the United Railroads each night during the week. The railroad company has donated flat cars and the use of its tracks for this purpose. An illuminated electric flag will head the pageant. In the parade will be floats showing "How Grandmother Kept House," "How Mother Kept House," and "How the Wife of To-day Keeps House." These floats will display the home utensils used in those periods.

At Syracuse, N. Y., an electrical show is planned, and the committee has rented a large retail store in the business section of the city. This store will be fitted up to represent a home, a farm, a factory and a city. Each member of the local committee will have exhibit accommodations in proportion to the extent of his participation in the enterprise. Another feature will be the flood-lighting of the Syracuse City Hall.

Rawson Collier reports that the Atlanta committee will center its activities about a great electrical show. Special illumination of the business center, with the prospect of flood-lighting of the city's principal buildings, and one or two pieces of statuary, are included in the program to date.

J. C. McLaughlin of the Potomac Electric Power Company reports Washington's activities to date comprise arrangements for an electrical show in a large downtown building and an electric pageant in which all of the electrical interests of Washington will participate.

H. M. Kohn of the Birmingham Railway, Light & Power Company announces the Alabama Electric Fair for the week of Dec. 2-8. Special efforts will be made to point out the advantages of electricity in the great rural sections of the South by this show.

On Nov. 8 and Nov. 15 700 of the city and town officials of Boston and suburbs will be guests of the Boston Edison Co-operative Development Committee. At these meetings C. L. Edgar, president of the Boston Edison company; E. W. Burdett, co-operation counsel, and W. H. Adkins, general superintendent of the Boston Edison company, will explain the ideas of America's Electrical Week and the plans of activities through all the territory reached by the company. During November the Edison company proposes to entertain all of the electrical contractors doing business in this territory, besides all the so-called journeymen who are employed by these contractors. The committee feels that by bringing together the 1500 journeymen in this territory the most efficient work will be done by these journeymen in promoting the uses of electricity in the homes with which they are in close touch.

W. H. Winslow of the Superior Water, Light & Power Company announces a local poster competition. One prize of $10 and five prizes of $2 will be given for the best posters designed by high school or normal school students of Superior. One prize of $5 and five prizes of $1 each will be given to the best poster designed by children in the grades attending any school in Superior. Each poster must have the words, "America's Electrical Week, Dec. 2 to 9, 1916, Superior, Wis., Do It Electrically."

SAN FRANCISCO'S PATH OF GOLD

Elaborate Electrical Pageant Marks Inauguration of New Downtown Street Lighting System.

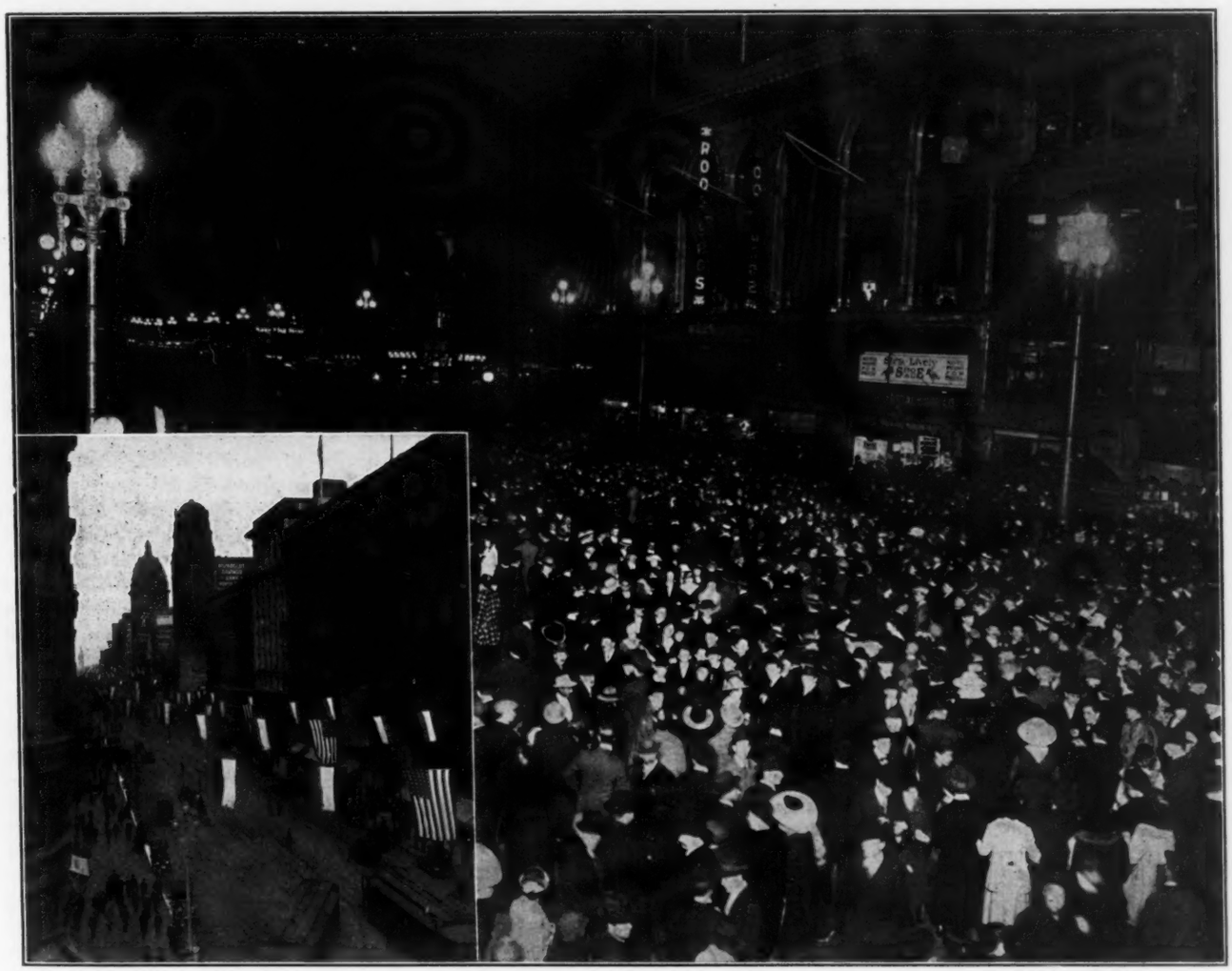
The new lighting system installed on Market Street in San Francisco was switched on for the first time on the night of Oct. 4, just ten months to the day after the same lights were turned off at the exposition grounds. The event was marked by an elaborate electrical pageant arranged in celebration of the new "Path of Gold," and was witnessed by crowds that rivaled the greatest throngs of the exposition year as will be seen in the accompanying illustration.

The lighting system, which was described by W. D'A. Ryan in the ELECTRICAL WORLD for Sept. 2, involves a new departure in street lighting, and great interest centered in the resultant effect on Market Street when it should be in service. Mr. Ryan expressed himself as fully satisfied with the effect, and the system is now officially in service under the contract arrangement.

In addition to the new street lighting system, there were several spectacular lighting features introduced for the occasion. The tower of the ferry building at the foot of Market Street, which is provided with an outline lighting system, was partially rewired for the occasion so that the top could be shown either in relief or in outline, both in red. The switches were thrown at fifteen-minute intervals, alternating between a solid red top and the glowing-red relief which was a characteristic feature of the illumination of the tower of jewels at the exposition.

Other features were the illumination of the city hall dome with twenty projectors, and the flood-lighting of building façades at various points in the downtown section. The chief feature of the pageant was a series of floats built up on auto trucks and street cars. The series was preceded by an animated reproduction of the "Aladdin—Symbol of Service" poster of America's Electrical Week, and included a score of floats, each representing some distinctive period in the development of illumination. These began with the torch of the cave man and ended with a representation of the decorative lighting features used at the Panama and Pacific International Exposition which was recently held at San Francisco.

On the second night of the carnival the central event was the ball at the municipal auditorium. The interior lighting features of the auditorium included four 18-in. projectors in opposite corners of the main hall directed against a pyramid of dahlias in the center of the floor, 20 ft. high and 20 ft. wide at the base. Between 30,000 and 40,000 blooms were used in interior decoration. A large portion of this number were arranged in eighty "bursts" around the gallery rail, each of which was illuminated by its own projector. These "bursts" were left on during the showing of colored pictures of the exposition lighting (projected on a 24-in by 36-in. screen), and provided a unique background for the lighting effects.



SAN FRANCISCO'S PATH OF GOLD AND DENSE CROWD THAT WITNESSED INAUGURATION OF SYSTEM

EVOLUTION IN PUBLIC UTILITIES

W. W. Freeman at Investment Bankers' Convention Discusses Stages Through Which the Industry Has Passed

With great emphasis on the point that the investor and not the consumer has reaped the greatest benefits from public service commission regulation, W. W. Freeman, president, Union Gas & Electric Company, Cincinnati, Ohio, discussed in a paper entitled "Evolution in Public Utilities" read before the convention of the Investment Bankers' Association, held at Cincinatti, Ohio, Oct. 2 to 5. What he considered to be the four great stages of the development of the utility industry, an era of initial promoter, era of exploitation, era of regulation and era of recognition.

Mr. Freeman's remarks on this subject in part are as follows:

"What I have in mind, in referring to the evolution of public utilities, is merely this: We have been passing through experiences for twenty-five or thirty years past that have been more or less interesting, and exciting, and trying. As the result of these experiences I believe public utilities are on a better basis to-day, and still more promising for the immediate future, than they have ever been before.

"There are perhaps three or four distinct eras in this evolution of the utilities. The first may be but briefly mentioned: the era of invention and of initial promoter or developer. Following that came the era of exploitation, of utilities generally, and this is the era with which so many of our friends among the public find so much fault; where attempts were made without restriction of any kind whatever as to the issue of securities or as to the payment of earnings to capitalize the privilege of serving the public, and to utilize that privilege for the mere purpose of extorting from the public all that could possibly be secured and paying out to the promoters the spoils. That seems to have been the conception of the average individual with regard to this era of exploitation of public utilities.

"We must confess, of course, that there was no restriction imposed by law upon the issue of securities, and that what happened was very largely the result of the capacity and the ingenuity of the promoter and the operator in each individual case.

"Then came the era of regulation on the part of the public and the attempt to do away with all of the abuses of the past, protecting both the investor and the consumer as to rates and to service, and while the theory of regulation is absolutely sound and is for the interest of the investor, no less than for the interest of the public, I am forced to the conclusion from my own experience that what was in the public's mind generally, in imposing regulation upon utilities, was not the protection of the investor but was to reduce the charges for service. It was because the general belief in the public mind was that rates were high and service was poor, that the people were being bled by public service corporations generally, and that these things would stop when regulation was imposed, that there was such a unanimous sentiment for the regulation of public utilities.

"We have had regulation for a good many years, longer in some states than in others, and operators will tell you that they had experience in connection with regulations that have been interesting, and have been at times annoying, and unfortunate.

"It is not the most pleasant thing in the world to have the power of life and death over your properties placed in the hands of men, however intelligent they may be, and sincere, who are absolutely unequipped from the standpoint of experience to undertake the duties suddenly imposed upon them, and operators will tell you, if they are frank, of repeated experiences where they had been told by those well-meaning people that theories which they themselves perhaps entertained years ago, but found to be fallacies, must be introduced in the operation of their properties.

"However, we have struggled through, assuming the good intent of the public with regard to regulation. The principal point I wish to particularly emphasize is that regulation in general, eliminating certain individual cases, has failed to produce the result that it was intended to produce, so far as the general conception of the public was concerned; and regulation has served today more for the investor, in proportion to what was expected and intended, than it has for the consumer, for the public.

Valuation Has Not Served to Reduce Rates

"As a first step in reducing rates, through regulation, the question of the valuation of properties was raised. Valuations became popular and numerous in various parts of the country. Then came the discussion of the rate of return to which a company was entitled, and attempts were made to devise certain standards as to certain rates applicable generally. The fact is, that the valuation of properties, the application of the theories of regulation to the average properties throughout the country, has not served to reduce rates or to produce the results that were generally expected and intended. Now, the reason must be this, that, notwithstanding certain abuses that may have existed, notwithstanding the absence of restrictions, there were automatic restrictions to the financing and operating of these properties, which gave the public the protection of which they were not aware, and which they sought to change through regulation.

"The rates for service of public utility companies have been more or less standard in all parts of the country, varying occasionally in localities, but these standards, which were accepted, perhaps without a full appreciation of what they involved, and the necessity for rendering good service, have served, without the knowledge of the public, in giving them the full measure of protection to which they were entitled, and giving them as much protection as they have secured by their more modern methods.

"Following this era of regulation, I believe that we are rapidly approaching finally one which I may perhaps call the era of recognition. I believe a new policy with respect to public utilities is forming in the public mind. I believe that policy can be accepted freely by the utilities, and accepted by the public. The first admission in connection with that policy should be that the only excuse for a public utility in any community is the necessity for a public service; that without that necessity the organization of the public utility is not justified; that it is the primary function to serve the public, and not to make any particular sum of money; that standard of service gives the utility the dignity in the community, as a real necessary public servant, and to the extent to which it fulfils that function it is entitled to the credit of the community for being a faithful public servant. Also coupled with that duty of the utility to the community there is an equally strong duty on the part of the community to permit the utility a fair and reasonable return for the service which it renders, and the measure of what is a fair and reasonable return is not any definite percentage on the capital, but is over and beyond the necessary expenditure for first-class service, the sum which will enable the company to obtain readily all the capital which it needs to give to the community the very highest grade of service. That may be one rate of per cent in

one community and another rate of per cent in another community.

"I find that most reasonable people will agree to that basis, and by the elimination of a discussion of capitalization, elimination of the discussion of a definite rate of return, and the comparison of figures with other figures from all parts of the country, that have no possible application, the basis of understanding seems practicable, which readily leads to amicable relations and satisfactory conditions.

"I believe that the future of our public utilities, based on past conditions, based on what the public has found as a result of their method of protection, based on present conditions, the future prospects—I believe that we have before us an opportunity as the operators of public utilities which serve the public faithfully to receive a just return for that service, and through you, as the purveyors of these securities, an opportunity to conserve the investors as well."

NEW YORK EDISON RATE CASE

Mr. Lieb Discusses the Three-Year Agreement, Public Benefits, Temporarily Increased Earnings and Rising Costs

Following public hearings before the New York Public Service Commission of the First District in the New York Edison Company rate case, a committee was appointed to confer on the questions involved. This committee is composed of Commissioner Hayward, representing the commission; Dr. Milo R. Maltbie, representing the city, and John W. Lieb, for the company. The position of the company, as presented before the commission by Mr. Lieb, is based upon a number of points in addition to the claim that there was every reason to believe that rates had been definitely established for a period of three years by the final order of the commission, which was accepted and went into effect on May 1, 1915.

Under the rate agreement the saving to customers of the company during the nominal year ended May 31, 1916, amounted, it is estimated, to $2,500,000, offset by an amount collected by the company under its lamp agreements approximating $300,000 and by a decrease in the cost of lamp renewals amounting to about $100,000, which left as the actual net saving to the customers approximately $2,100,000 per year.

Continuing, Mr. Lieb declared that had it not been for the extraordinary conditions which arose almost immediately after the order was put into effect the loss above computed would have been reflected in the earnings for the year, but the abnormal increase in sales of energy, due to the unparalleled conditions in the industrial world, operated to offset temporarily the loss in earnings, so that the actual reduction in the revenue from electric operations amounted in the year to $518,000.

During the first six months of 1914, the output of commercial energy increased 8.94 per cent; in the next six months it increased 5.48 per cent; in the first six months of 1915 it increased only 2.6 per cent. Had nothing occurred to better business conditions the sales for the following months would probably have shown an actual decrease, said Mr. Lieb. However, general business conditions had improved so that the increase in commercial sales for the last six months of 1915 rose to 6.45 per cent, and during the first six months of 1916 the increase over the corresponding period in 1915 was accelerated to 15.13 per cent. There is no evidence of permanence in the ephemeral improvement in the business to justify its exploitation as a basis for the further reduction of rates at this time, or within the period covered by the commission order.

Of the class of very small consumers the company now has 45,000, each of whose electric light bills amounts on the average to less than $2 per month. Unless a minimum charge in some form is prescribed, which would materially reduce the number of small consumers who are supplied at a loss, it is believed that no one would seriously suggest the adoption of a maximum rate less than the present 8 cents per kilowatt-hour.

Gross income for the calendar year 1914 was $23,538,342; for 1915 it was $22,546,068, a loss of $992,274. Anticipating a material reduction in revenues from the change in the rate the company has exercised stringent economies, has refrained from making in some departments the customary additions in working forces, and has curtailed in all departments the wage and salary advances.

Further increases in labor costs are imminent, and the increased cost of materials and supplies is general and unprecedented. The indications are that coal will rise materially above present high costs.

With the maximum rate at 8 cents, any further changes when contemplated should rather be in the wholesale and industrial rates. The effort is, through large aggregate output and by maintaining at all times the highest conditions of efficient operation, to be able to make rates for large manufacturing and industrial enterprises located within the city which will offset the high local cost of real estate and labor and lessen the handicap arising from the advantages presented by other localities.

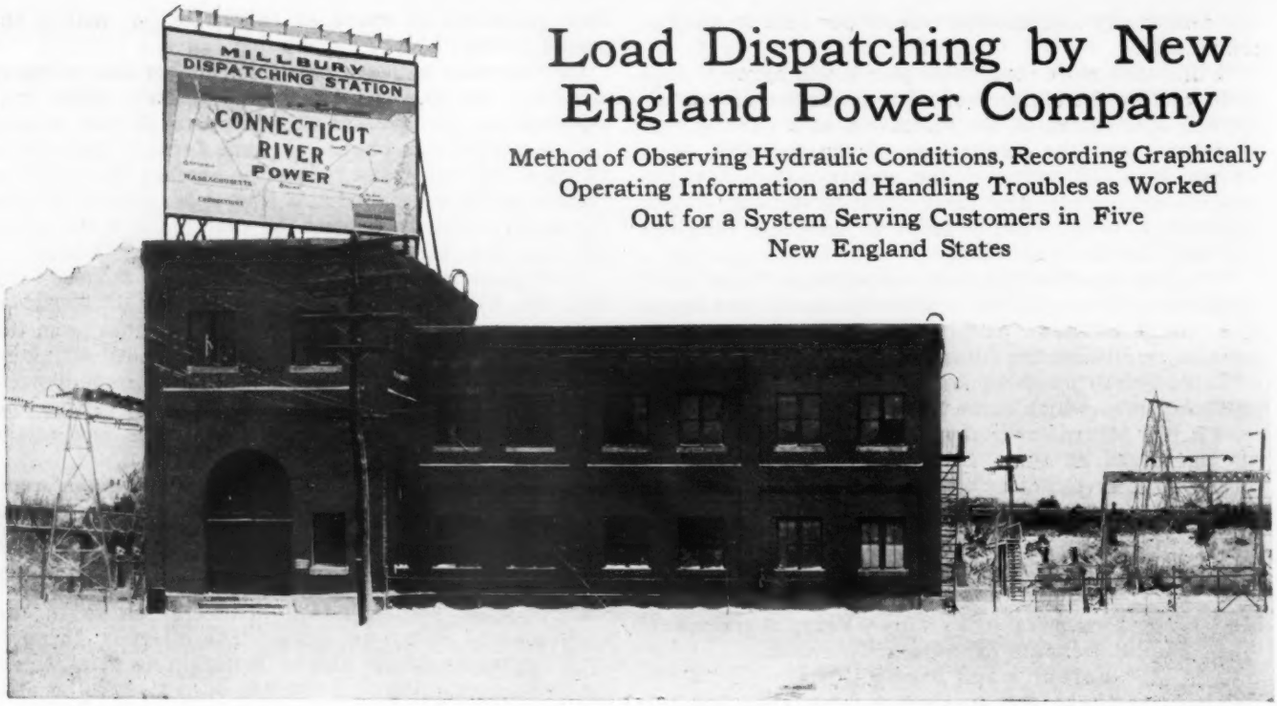
It is urged that there is an entire absence of any necessity for a formal appraisal of the property except as a last resort where irreconcilable differences of opinion seem to exist. An appraisal would cost the company in direct expenditure in excess of $250,000, with large additional costs resulting from work from the permanent staff. It would cost the commission at least a similar amount.

It was stated by Mr. Lieb that earnings for the year ended May 31, 1916, over interest on debt and dividends on stock, and a reserve for contingencies amounted to but $1,885,000, which is about 3 per cent on more than $60,000,000, the amount which the company claims represents its assets over those represented by capital stock and interest bearing obligations, a deficiency in earnings, based on the value of these assets, below a fair return thereon, computed at 8 per cent, of over $3,000,000. The average dividend distributed annually since 1900 is less than 4 per cent.

New York Electrical Exposition

More magnificent than ever is the 1916 New York Electrical Exposition and Motor Show which started last Wednesday to continue through next Saturday. As in former years the exhibits have been arranged as a broad education in the use of electrical appliances and apparatus. Much interest is manifested in the popular exhibits which are not strictly electrical. The United States Navy has a very comprehensive exhibit taking up one whole end of the exposition. Another popular feature is the weaving of silk carried on during the show. The New York vocational schools are winning great praise for their exhibits, which include a demonstration of all phases of this system.

The three local electric lighting companies, the New York Edison Company, the United Electric Light & Power Company and the Edison Electric Illuminating Company of Brooklyn have large and attractive exhibits that are very popular with the visitors.



Load Dispatching by New England Power Company

Method of Observing Hydraulic Conditions, Recording Graphically Operating Information and Handling Troubles as Worked Out for a System Serving Customers in Five New England States

THE New England Power Company operates one of the largest hydroelectric transmission systems in the East. Its six main generating stations of a combined rating of about 56,000 kw. supply energy over 300 miles of steel tower and pole lines to large manufacturing concerns and public utility companies in Massachusetts, Vermont, New Hampshire, northeastern Connecticut and Rhode Island. The initial development of an ultimate rating of 20,000 kw. on the Connecticut River at Vernon, Vt., 5 miles from the Massachusetts State border and 66 miles of 66,000-volt transmission lines was the first hydraulic project in New England to sell energy in bulk to groups of towns and cities. The wisdom of the proposition was borne out by the fact that before the station was placed in operation in 1909, and practically without solicitation, enough energy was contracted for, to cover the fixed charges and operating expenses. The details of this installation were described in the ELECTRICAL WORLD of Sept. 9, 1909. The system has been extended by the construction of four plants on the Deerfield River at and within a radius of 10 miles of Shelburne Falls in northwest Connecticut at an expenditure of around $5,000,000. Descriptions of plants Nos. 2, 3, 4 and 5 of the Deerfield River and the transmission line extensions which have enabled the efficient interchange of energy between the Deerfield and Connecticut River systems were published in the Dec. 28, 1912, issue of the ELECTRICAL WORLD. The outdoor switching installation at Millbury, Mass., which at the time of construction was an advanced example of design, and the 120,000-volt transmission line between this station and the Shelburne Falls generating station, together with the various substations and steam generating plants, were also described in the Oct. 4 and Oct. 11, 1913, issues of the ELECTRICAL WORLD. Data on transmission line costs appeared in the July 17, 1915, number.

The annual output for the system has increased from 34,000,000 kw.-hr. in 1910 to 173,000,000 kw.-hr. in 1915. The greatest increase is reported for 1915, being 50,000,000 kw.-hr. more than for the preceding year. During that period plant No. 5 on the Deerfield River, operating under a head of 240 ft., was placed in operation and credited with an output of 35,000,000 kw.-hr. Also during 1915 the high-tension lines were extended southward from Uxbridge, Mass., through Woonsocket to Pawtucket and Providence, R. I., and a substation for supplying energy in central Rhode Island completed and placed in operation in the fall of that year. During the present year a hydraulic plant purchased from the National Metal Edge Box Company at Readsboro, Vt., on the Deerfield River, has been rebuilt and placed in operation. The ownership of this property gives the company entire control of the Deerfield River from a point just south of Wilmington, Vt., to Shelburne Falls, Mass., a distance of 35 miles.

FIG. 1—TRANSMISSION LINES CONNECTING GENERATING AND SUBSTATIONS OF NEW ENGLAND POWER COMPANY

In connection with the operation of this extensive system, load dispatching methods have been developed to a high standard of efficiency, and the facilities for this work at the dispatching headquarters at Millbury, Mass., are of engineering interest.

The present high-tension lines of the company are shown in Fig. 1, and extend from the Deerfield and Connecticut River valleys southeasterly through central Massachusetts into Rhode Island. The location of the five hydroelectric generating stations now operated on the Deerfield River of a combined rating of 36,000 kw., and the 20,000-kw. plant on the Connecticut River at Vernon, Vt., besides about 50,000 kw. of auxiliary steam and hydraulic equipment either owned or under contract, are shown on the map. Worcester (Mass.), Fitchburg (Mass.), Providence (R. I.), and many other important Massachusetts cities and towns now use large amounts of energy from the New England system, and the local central stations are in general prepared to deliver energy to the New England company at times of low water. The local central stations purchase 35 per cent, large industrial power users 50 per cent, and electric railways 15 per cent of the company's output.

system, and is within a stone's throw from the Millbury turbine station of the Worcester Consolidated Street Railway, the two systems being connected through a frequency changer and tie lines. Besides being the dispatching headquarters of the New England company, the Millbury installation also contains substation equipment for local distribution. An exterior view of the Millbury operating headquarters and substation building is shown in the illustration at the beginning of this article. A notable feature is a 20-ft. by 30-ft. roof sign, on which is displayed a map of the principal high-tension lines, illuminated by ninety-nine 25-watt tungsten lamps mounted in a horizontal reflector at the top of the map.

The load dispatcher's office, shown in Fig. 4, is located in the southerly portion of the substation building. Eight men are employed here, including one chief load dispatcher, three dispatchers working on eight-

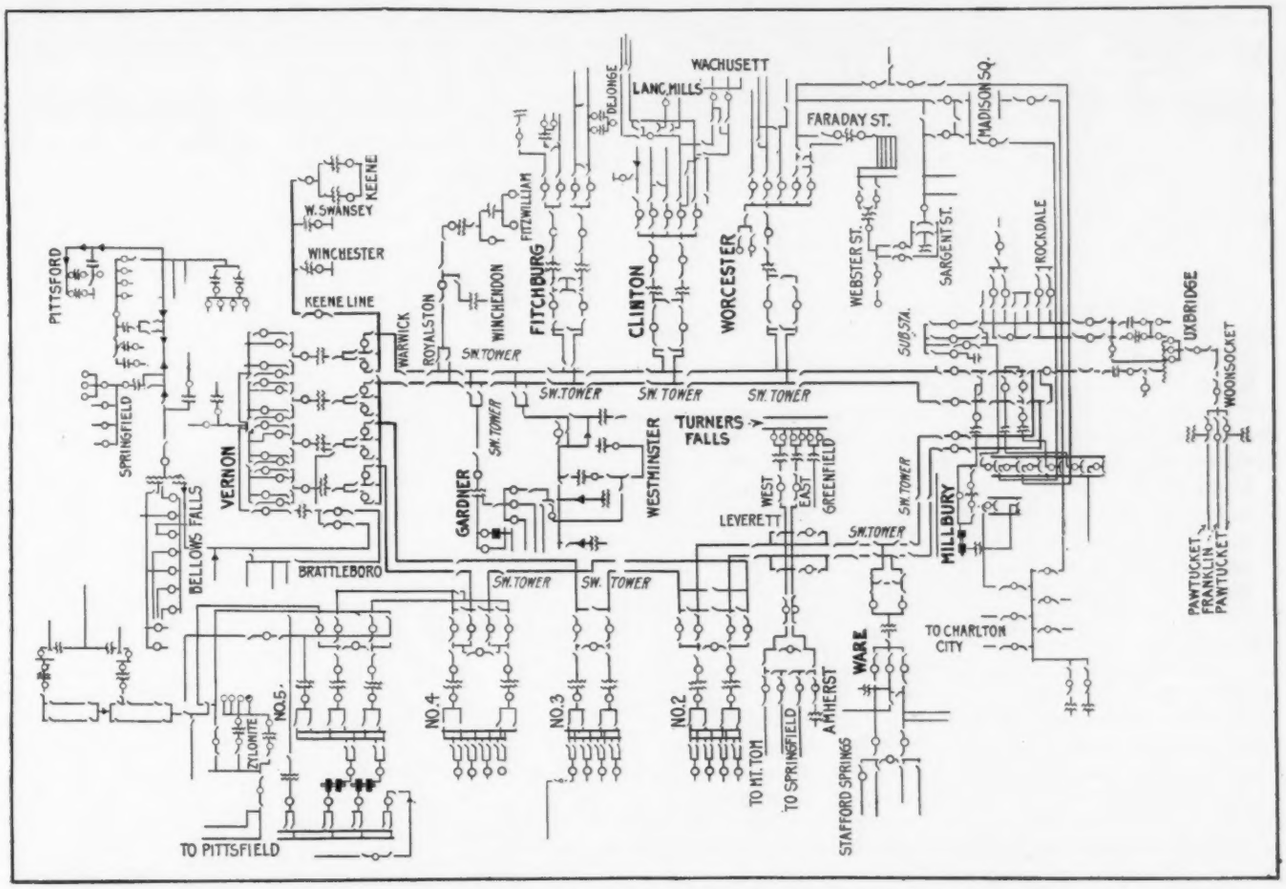


FIG. 2—CONNECTIONS FOR GENERATING AND SUB-STATION EQUIPMENT OF NEW ENGLAND POWER COMPANY'S SYSTEM

The high-tension lines are designed for operation at 66,000 and 120,000 volts, and form a loop in central Massachusetts which ties all the company's generating plants together, making it possible to feed any of the inclosed substations from either direction and over either of two three-phase circuits, both lines in the loop being double. A very careful study has been given to automatic relays, so that when trouble occurs on any circuit the load may be automatically transferred to the good circuit. Balanced power relays automatically protect all four lines, and are installed at Millbury, Mass.

MILLBURY DISPATCHING STATION

At Millbury, Mass., about 6 miles south of Worcester, the lines from the Deerfield valley and Vernon stations terminate in an outdoor switching station from which the Rhode Island line starts southward. This station is a most important electrical operating point in the

hour shifts, one spare man, one forecaster of loads, who is capable of taking a shift, one station operator and one clerk. The various incoming and outgoing high-tension lines are controlled by oil switches located in the yard and governed by remote-control switches on a bench board in the load dispatcher's office. The control for these lines, the telephone facilities centering at this point, and the system diagram shown at the right in Fig. 5 are the chief features of interest, supplemented by an unusually complete record system.

The arrangement of incoming and outgoing lines at this station was described in the Oct. 4, 1913, issue of the ELECTRICAL WORLD.

ATTENTION PAID TO HYDRAULIC CONDITIONS

The Connecticut River north of the Vernon station has a drainage area of about 6200 square miles. There are ten gaging stations and seventeen precipitation sta-

tions. On the Deerfield River at and above the company's plants are six precipitation and nine gaging stations. The area of the Deerfield watershed above the lowest station of the company is about 550 square miles. Gaging and precipitation stations outside the generating plants are provided with printed post cards on which are recorded the daily heights of water and

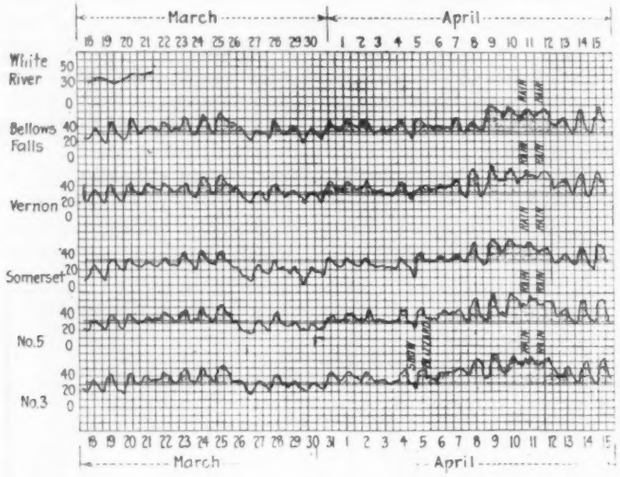


FIG. 3—METHOD OF RECORDING TEMPERATURES TELEPHONED TO DISPATCHER EVERY TWO HOURS DURING WINTER AND SPRING MONTHS

rainfall, with the name of the observer and the station, these routine records being mailed weekly to Millbury for file records. Each observer within 125 miles of the Vernon station also sends in a daily gage card. On the Connecticut River from fifteen to twenty observers are employed by the company, the river being covered by them from Bellows Falls, Vt., to West Stewartstown, Vt., about 2 miles south of the Canadian border. In case the rainfall reaches 0.25 in. or more in twenty-four hours, these observers telegraph the fact to Millbury at the company's expense.

There is about 1,000,000-kw.-hr. storage capacity available in the Connecticut River above the Vernon plant, but on the Deerfield there is a reservoir owned by the company at Somerset, Vt., which has a total storage capacity of 25,000,000 kw.-hr. The latter is one of the company's most valuable assets. Temperature records are telephoned to Millbury from Bellows Falls, from the Somerset dam, Vernon and two of the Deerfield stations every two hours, day and night, during the winter and spring months. The load dispatcher's log sheet also records the hourly kilowatt-hour output of every station, elevation of water at every dam, temperature data, location of patrolmen, conditions regarding use of flashboards, floodgates, racks, and other information, mainly transmitted by telephone. If the river rises 6 in. or more in half a day, the observers wire the fact to Millbury. Extended plots of the height of water at the gaging stations, of load variations and of temperature changes are maintained. In Fig. 3 is shown a temperature plot during portions of two spring months, the areas of melting being shaded in above the freezing line as a base and furnishing valuable indications to the load dispatcher of the probable flow of water in the different watersheds. The possible output of the various hydroelectric stations is calculated in kilowatt-hours the flowage of the rivers and the pondage being measured in electrical terms.

From the study of these charts, combined with analyses of the readings of gaging stations, as plotted in Fig. 4, the economical use of water is greatly facilitated. Daily forecasts of the load anticipated are made at Millbury, and so far as possible arrangements are made to handle the load in the most efficient manner as regards the use of water or steam power. It has been found that about two days are required for water to flow from the Somerset dam to station No. 2 on the Deerfield River at Shelburne Falls, Mass., while the maximum flow on the Deerfield usually occurs about thirty hours after a storm. On the Connecticut River the maximum flow generally comes about three days after a storm.

Handling of Operating Troubles

Operating troubles on the system are recorded on service disturbance sheets, which have the system connections printed thereon, as shown in Fig. 2, and these are forwarded to the load dispatcher. These sheets are designed to give as complete a record as possible of the conditions prevailing at the time of the trouble, its location on the system, the position of various oil and disconnecting switches, use of auxiliaries, duration of irregularities of supply, interruptions, etc. Anything affecting the even delivery of power at the normal voltage and frequency to any consumer is defined as a service disturbance. As soon as possible after a disturbance the fact is telephoned to Millbury and a number is assigned to the record sheet by the load dispatcher for use on the sheet and in future references to the occasion. A diagram of the high-tension system and the more important lower-voltage distribution lines is printed on each sheet, and each operator is supplied with instructions on each sheet which require him to plot the condition of every switch in his jurisdiction at the time of the trouble. In filling out a record of disturbance, oil switches which were closed previous to the trouble are indicated in red, and if open in green. Disconnecting switches are shown closed by black lines. Switches opening at the time of disturbance are marked with a red arrow, and whether the opening was automatically or manually effected is also shown.

Load Dispatcher's Equipment

The system diagram at Millbury shown at the right of Fig. 5 is 10 ft. long and 8 ft. wide is in the office of the load dispatcher. This shows the open or closed position of all oil switches on the transmission lines and

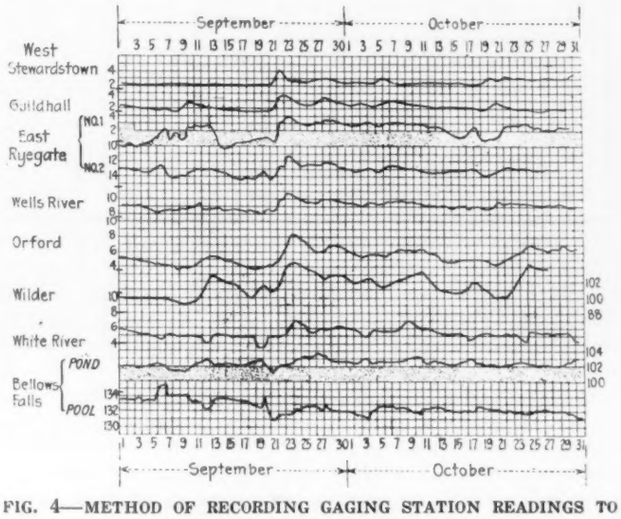


FIG. 4—METHOD OF RECORDING GAGING STATION READINGS TO USE WATER MOST ECONOMICALLY

high-voltage distributing lines. The map is mounted on a white pine base carried in a steel frame, which prevents warping at front or back. The expansion is taken up by springs at the top.

The load dispatcher's desk is 30 in. wide by 8 ft. long, so that two operators can work side by side if necessary. It contains two private telephone switch-

boards, time stamp, an a.c. voltmeter and frequency indicator of Weston make, mounted on a swinging bracket. A second table just behind, 3 ft. wide and 6 ft. long, carries public telephone sets, curve-drawing voltage and frequency meters, a system log book and card index. The card index is said to be one of the most valuable features of the headquarters office. One section contains the names and addresses, with telephone numbers, of all employees of the New England Power Company, including gage readers, and a record of all power plants, lines and customers' equipment. The index of customers' equipment includes the addresses and telephone numbers of executives of each firm or company served by the company, including assistant superintendents, local chief engineers, the capacity of local steam generating units, number and voltage of feeders supplying each establishment. A section of the index devoted to customers includes individuals in a red-starred "tagging list," who have authority to order their local feeder killed for local repairs or changes. A general file includes load curves, wiring diagrams, field sketches, and special instructions to employees. A 250-watt tungsten lamp in a Brascolite fixture mounted 6 ft. above the dispatcher's table furnishes the main illumination for the office. A telephone booth with three instruments is also provided.

All operating troubles are analyzed thoroughly and recorded in the dispatcher's office, so that the recurrence of any difficulty in any locality or at any particular point can be studied from every feasible angle. Troubles are classified as associated with careless operation, defective equipment, failure of auxiliaries, faulty construction, inadequate equipment, lightning and lightning arresters, outside interference, overloads, pin and suspension insulators, relays, rotaries, sleet and ice, transformers, trees, unknown causes, foreign companies, wires off insulators, floods, oil switches, governors and disconnecting switches. W. R. Bell is chief load dispatcher of the company.

The Connecticut and Deerfield River developments have been carried out under the general direction and control of Chace & Harriman, Inc., of Boston, Mass., through the corporate organizations of the Connecticut River Power Company of New Hampshire and the New England Power Company respectively. The New England Company, a holding corporation, owns the common stock of the New England Power Company, of the Connecticut River Power Company of New Hampshire and of the Rhode Island Power Transmission Company.

The New England Power Company owns the five hydroelectric transmission plants on the Deerfield River and all transmission lines and substations in Massachusetts. The Connecticut River Power Company of New Hampshire owns the hydroelectric plant at Vernon, Vt., on the Connecticut River, Hinsdale, N. H., being on the opposite side of the stream, with transmission lines in both States. The Rhode Island Power Transmission Company owns transmission lines and substations in Rhode Island. All three are operating organizations, forming a single system. All the other corporate organizations affiliated with these interests have been annulled, the consolidation of the Connecticut River Transmission Company with the New England Power Company under the name of the latter having occurred in 1916, through an approving decision of the Massachusetts Gas and Electric Light Commission.

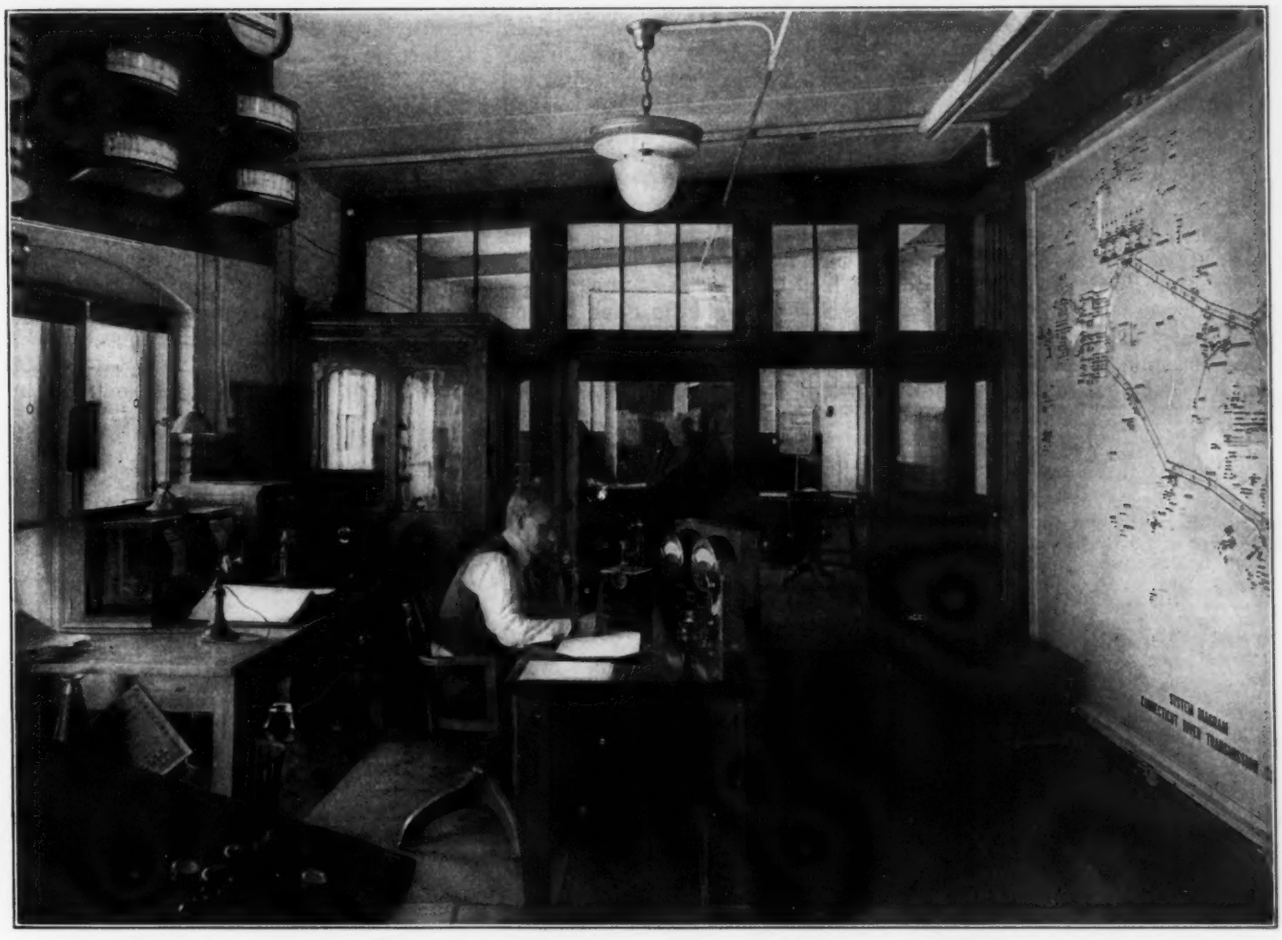


FIG. 5—LOAD DISPATCHER'S OFFICE OF NEW ENGLAND POWER COMPANY AT MILLBURY, MASS.

How Oil Burners Help Boilers Over Peak Loads

Arrangements Employed in St. Joseph (Mo.) Station to Burn Coal and Fuel Oil Under Boilers, Test Data When Using Oil and Details of Furnace Construction

BY rearranging one of its boiler batteries into a front-and-rear-fired boiler, and by installing different systems of oil burners under other boilers, with provision for quickly changing back to coal firing in an emergency, the St. Joseph (Mo.) Railway, Light, Heat & Power Company has insured itself against possible operating difficulties due to shortage of either oil or coal. In addition, the efficiency of the boilers and of the station as a whole has been increased by the use of oil by making it possible to keep a minimum number of boilers in operation.

The overload rating of one of the boiler batteries was increased from 120 per cent of full-load rating to 250 per cent by making simple alterations in the boiler interior and installing oil burners at the rear. Under normal load this battery is operated at about 120 per cent full-load rating, using only the chain-grate stokers. During peak load the additional capacity is secured by turning on the oil burners at the rear, instead of firing additional boilers.

ARRANGEMENT OF OIL BURNERS

Oil burners, of the Billow and Hammel types, were installed in the rear wall of the setting, as shown in Fig. 1, and piped back to the oil and steam header pipes along the back of the furnace wall. For inspection purposes a 4-in. pipe extending back through the rear wall was installed for each burner. Through these it is possible to observe the condition of the burner flame. The bridge wall was cut down 2 ft., and the bottom row of boiler tubes was sealed across, from the bridge wall back to the mud drum. This conducts the hot gases from the oil burners up through the tubes in front of the first baffle plate, and the lowered bridge wall gives more clearance for these gases to pass. The back baffle plate was also cut off to above the four bottom tubes to make a passage between it and the bottom-tube sealing.

On other boiler batteries, No. 11 and No. 12 in the company's power station, the coal grates have been removed altogether and oil burners of home-made design installed instead. The oil and steam header pipes along the front of the furnace wall with connections from each to the burner pipe are clearly shown in the accompanying illustrations. Still another boiler, No. 10, formerly fired with Taylor stokers, has been equipped with oil burners installed in such a manner as to leave the stokers and grates in place for emergency use in case there should be a scarcity of oil. The coal hoppers were removed and the oil and steam piping placed along the front of the furnace immediately above the stokers. In case it is necessary to use coal at any time the grate and stokers can be quickly put in service by knocking the support out from under the T-bars which carry the brick lining above the grates for their protection from the oil-blast flames. The T-bars will then fall down and the brick can be dumped into the ash pit. The piping in front of the furnace is easily disconnected, the burners pulled out, and the coal hoppers set in place, closing the burner holes. The air space below for the

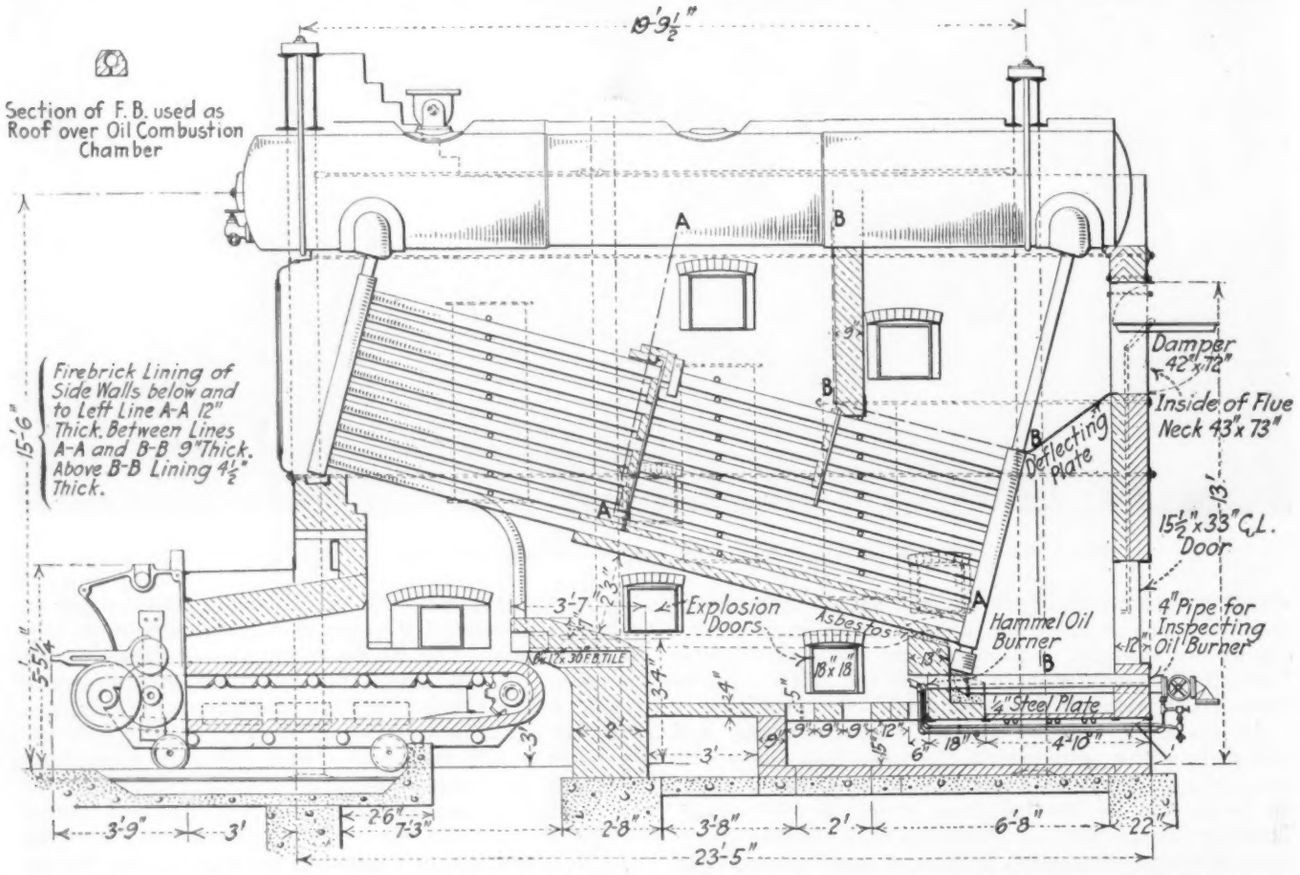

Section of F. B. used as Roof over Oil Combustion Chamber
Firebrick Lining of Side Walls below and to Left Line A-A 12" Thick. Between Lines A-A and B-B 9" Thick. Above B-B Lining 4½" Thick.
Damper 42"x72"
Inside of Flue Neck 43"x73"
Deflecting Plate
15½"x33" C.I. Door
Explosion Doors
Asbestos
Hammel Oil Burner
4" Pipe for Inspecting Oil Burner
¼" Steel Plate
18"x18"
23'-5"

FIG. 1—SECTION THROUGH BOILER SHOWING AUXILIARY OIL BURNERS AT REAR WALL AND PIPE FOR OBSERVING FLAME

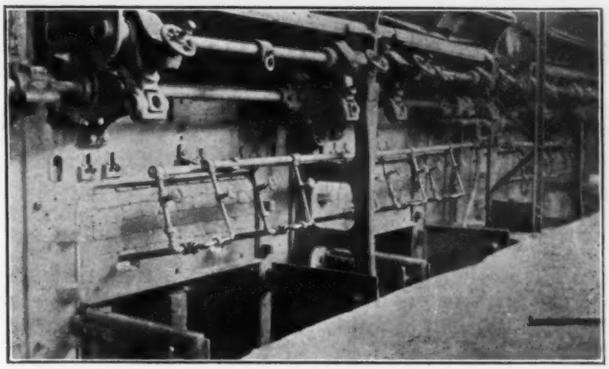


FIG. 2—OIL AND STEAM HEADER PIPES AND BURNERS ON FRONT OF BOILERS NOS. 11 AND 12

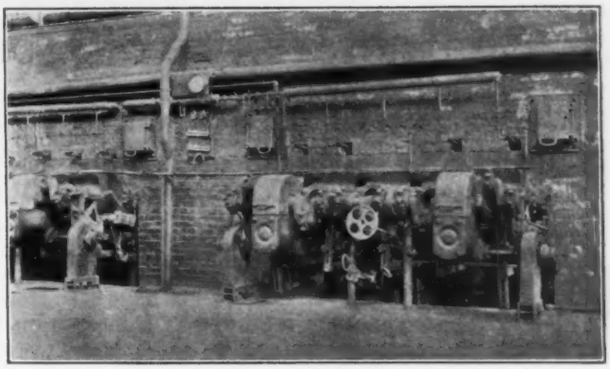


FIG. 3—OIL BURNERS INSTALLED HIGH IN FURNACE WITH STOKERS IN PLACE FOR EMERGENCY USE

supply of air to the combustion chambers is done away with automatically when the T-bars and brick are removed. The boiler is then ready for coal firing, and this rearranging can be done in a very short period of time.

Complete test data, showing the operating characteristics of boiler batteries Nos. 10, 11 and 12 are given herewith, and indicate the increased efficiency obtained with the oil burners. The boiler efficiency for these units under coal firing was approximately 70 per cent according to similar tests made previous to the installation of oil burners, as against approximately 79 per cent under oil firing. The test efficiency on boiler battery No. 10, as shown, is about 5 per cent lower than that on No. 11 and No. 12, which is due to the fact that the burners were placed high in the furnace to allow the grates to remain in place. The third test on boiler No. 10 shows a somewhat better efficiency than the first and second tests, since the boiler was washed just previous to the test run.

With one battery firing coal only and another firing coal in front and oil in the rear normally, and still another in which the oil fixtures can be quickly removed and the stokers already in place put in service, a scarcity of oil can cause no serious operating trouble. With one battery firing oil only and another firing oil above the grates normally, and still another firing oil from the rear, a scarcity of coal may be readily coped with. Under normal operation the coal-fired boilers are worked under practically constant fire, and the fluctuation in load is taken care of almost entirely with the oil-fired boilers, which lend themselves readily to control.

RESULTS OF BOILER TESTS WHEN USING KANSAS FUEL OIL IN STATION OF ST. JOSEPH (MO.) RAILWAY, LIGHT, HEAT & POWER COMPANY

	Babcock-Wilcox Boilers			Stirling Boilers			
Boiler Number	10	10	10	11	11	12	12
Duration of test, hours	8	8	8	9	8	7	8
Steam pressure, pounds gage	154	155	153	157	153	155	152
Atmospheric pressure, pounds gage	14.2	14.2	14.2	14.1	14.4	14.4	14.4
Absolute pressure, pounds	168.2	169.2	167.2	171.1	167.4	169.4	166.4
Steam temperature, deg. Fahr.	367.6	368.1	367.1	408	431	427	428
Superheat, deg. Fahr.	.....	.....	.....	39	64	59	61
Moisture in steam, per cent.	2.13	2.04	1.28	.....	.....	.....	.....
Temperature of feed water, deg. Fahr.	144	140	166	148	167	151	145
Factor of evaporation	1.1164	1.1207	1.0938	1.1375	1.1320	1.145	1.1526
Average water level, inches	4½	4½	6	3	5	6¾	8¾
Barometer, inches	28.85	28.94	28.93	28.79	29.22	29.35	29.32
Temperature outside, deg. Fahr.	42	39	27	34	22	18	10
Temperature boiler room, deg. Fahr.	80	71	82	78	83	75	74
Temperature flue gases, deg. Fahr.	511	509	462	533	472	511	482
Draft in furnace, inches	0.07	0.07	0.06	0.08	0.04	0.08	0.07
Draft in rear pass, inches	0.12	0.11	0.09	0.29	0.06	.....	0.11
Carbon dioxide, CO_2 per cent.	11.5	12.8	13.3	12.8	12.6	12.6	10.6
Oxygen, per cent.	5.5	3.4	3.0	3.8	4.4	4.1	6.7
Carbon monoxide, CO per cent.	0.05	0.07	0.07	0.05	0.06	0.01	0
Air excess, per cent.	33.5	19.0	16.0	21.0	25.5	23.0	45.0
Total water apparently evaporated, pounds.	96,231	98,552	95,456	239,135	133,517	156,524	126,105
Total water corrected for moisture, pounds.	94,181	96,542	94,234	.....	.....	.....	.....
Total water evaporated from and at 212 deg. Fahr., pounds	105,144	108,195	103,073	271,992	151,141	179,220	145,340
Water per hour from and at 212 deg. Fahr., pounds	13,143	13,524	12,884	30,221	18,892	25,603	18,168
Steam used, by burner, pounds per hour.	330	324	350	552	326	.....	.....
Per cent steam generated	2.74	2.63	2.93	2.07	2.44	.....	.....
Steam pressure to burners, pounds	58	66	63	66	63	61	58
Oil pressure to burners, pounds	78	82	82	82	83	91	69
Temperature of oil to burners, deg. Fahr.	167	172	164	170	177	161	151
Specific gravity of oil at 60 deg. Fahr.	0.8974	0.8975	0.8968	0.8965	0.8962	0.8975	0.8969
Specific gravity of oil Baumé at 60 deg. Fahr.	26.01	26.00	26.12	26.17	26.22	26.00	26.13
B.t.u. per pound of oil as fired	19,404	19,372	19,396	19,380	19,418	19,381	19,381
Total oil as fired, pounds	7,075	7,293	6,792	17,050	9,480	11,590	9,169
Oil per hour, pounds	884.4	911.6	849	1,894.4	1,185	1,655.7	1,145
Water evaporated from and at 212 deg. Fahr. per square foot heating surface per hour in pounds	2.99	3.07	2.93	4.41	2.76	3.73	2.65
Boiler-horsepower, builder's rating	440	440	440	686	686	686	686
Boiler-horsepower developed	381	392	373.5	876	548	742	527
Per cent builder's rating	86.6	89.1	84.9	127.7	79.98	108.1	76.8
Water evaporated per pound oil from and at 212 deg. Fahr., pounds	14.86	14.84	15.18	15.95	15.94	15.46	15.85
Boiler efficiency, per cent.	74.32	74.35	75.96*	79.88	79.68	77.70	79.37
Fuel cost per 1000 lb. steam evaporated, cents.	18.53	18.55	18.14	17.26	17.27	17.80	17.36

NOTE.—Kind of oil, Chanute Refining Company, Chanute, Kan. *No. 3 test was made after boiler had been washed.

Characteristics of Iron and Steel Conductors

Results of Tests Showing Comparative Suitability of Different Stranded Iron and Steel Wires as Transmission Line Conductors and Formulas for Calculating Their Characteristics

BY CHARLES E. OAKES AND WINFIELD ECKLEY

UNDER normal conditions of the metal market in the past, a few operating companies have used iron and steel conductors to a limited extent for transmission and distribution lines where small loads were to be transmitted. The recent rise in the price of copper and aluminum has, however, caused a more thorough investigation of the economic use and the electrical characteristics of iron and steel conductors. In what follows here the results of tests to determine the possible use of these metals as conductors from an economic standpoint will be outlined.

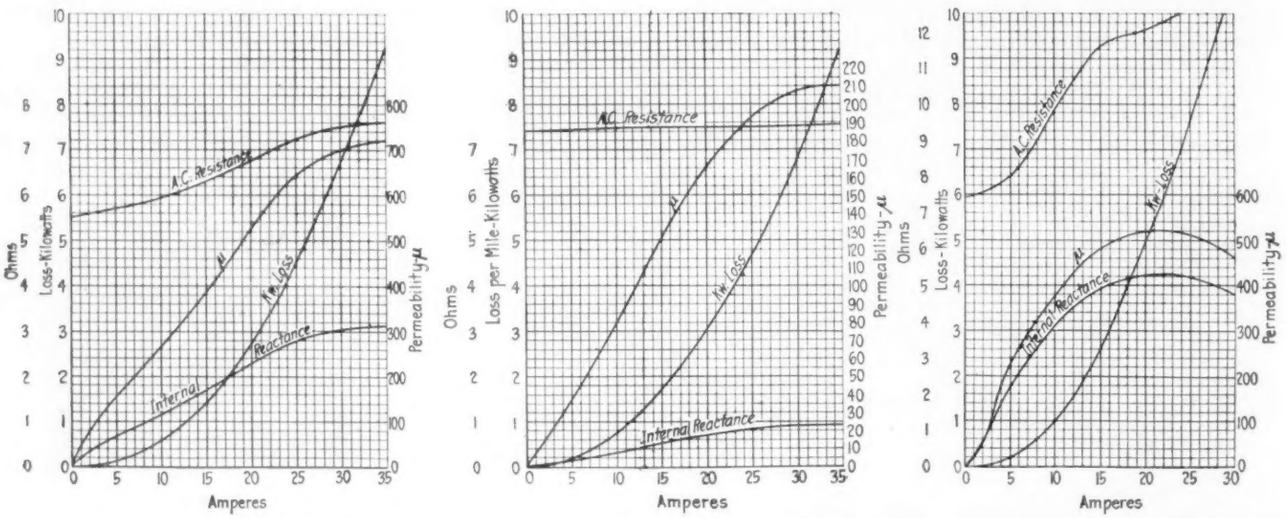
The resistance of a conductor carrying an alternating current is affected by the frequency and magnetic properties of the conductor. For non-magnetic conductors the increase in resistance due to skin effect, except for very large conductors, is negligible, but for iron or steel wires the skin effect causes a material increase in resistance. The effect is also cumulative. The permeability increases with the current density within certain limits, and as skin effect is due to a greater self-inductance (a function of the permeability) at the center of the wire than at the surface, an increase in resistance with an increase in current results. Because of the magnetic properties of iron and steel, the computation of the skin effect is rather difficult. Other factors affecting the power loss in a magnetic conductor are the hysteresis and eddy current losses. The effective resistance is a function of all these factors and is a value such that when multiplied by the square of the current will give the power loss in the line.

The reactance of a conductor composed of a magnetic material is a variable and is composed of two factors: the external reactance, which is easily computed, and the internal reactance, which is a function of the permeability. Due to the fact that permeability depends not only on the current density, but also on the physical properties of the material, the internal reactance cannot be computed accurately unless a permeability curve is at hand. It should be also noted that the internal reactance is due to circular magnetization, and therefore the permeability for circular magnetization should be used.

The various electrical and magnetic constants for any particular grade of iron or steel wire cannot be given with any absolute degree of accuracy because of the method of manufacture. A slight change in the ingredients of the wire that would not affect the mechanical properties would cause a material change in the electrical and magnetic characteristics. For this reason, unless accurate test data is available, any computations that may be made would necessarily be only approximate.

CHARACTERISTICS OF IRON AND STEEL CONDUCTORS

The accompanying curves, Figs. 1, 2, 3 and 4, give the internal reactance, alternating-current resistance, power loss and permeability of different sizes and qualities of iron and steel wire that might be used for transmission lines. The data was secured from tests made on wires approximately 1000 ft. in length and spaced 30 in. apart. The internal reactance was obtained by subtracting the computed external reactance from the measured reactance. The following formulas, which are modifications of those by Dwight, give the reactance in ohms per mile of single conductor for the various conductors tested:



FIGS. 1, 2 AND 3—CONSTANTS FOR ONE MILE OF 7-STRAND STEEL AND 3-STRAND IRON WIRE AT 60 CYCLES AND TEMPERATURE OF 20 DEG. C.

The Curves in Fig. 1 are for a 7-strand 5/16 in. ordinary galvanized steel cable; those of Fig. 2 for 7-strand 5/16 in. Siemens-Martin galvanized steel cable and those of Fig. 3 for 3-strand No. 10 B.W.G.—B.B. galvanized iron wire.

The reactance at 60 cycles for No. 6 B. W. G. solid B. B. galvanized iron is,

$$X = 0.27941 \log_{10} \frac{D}{0.1055} + X'$$

The reactance at 60 cycles for 5/16-in. seven strand Siemens-Martin or ordinary grade galvanized steel is,

$$X = 0.27941 \log_{10} \frac{D}{0.0545} - 0.09865 + X'$$

The reactance at 60 cycles for three strands of No.

10 B. W. G. B. B. grade galvanized iron is,

$$X = 0.27941 \log_{10} \frac{D}{0.144} - 0.0371 + X'$$

In these formulas, X is total reactance in ohms per mile of line; X' is internal reactance from curve; D is spacing in inches.

The inductance of a seven-strand cable of a non-magnetic material as given by Dwight* is,

$$L = \frac{1}{49}(98 \log_e \frac{S}{r} + \frac{7}{2} - 24 \log_e 2 - 60 \log_e 2 - 12 \log_e 6) \text{ per cm.}$$

For a three conductor cable the formula is,

$$L = 2 \log_e \frac{S}{2.153r} + \frac{1}{6} + 2 \log_e \left(\frac{2\sqrt{3+3}}{3}\right) - \frac{4}{3} \log_e 2 \text{ per cm.}$$

In these formulas, L is inductance in cm.; S is spacing; r is radius of each strand in the same units as S.

These formulas are based on the assumption that the current density in each wire making up the cable is uniform and that the wires, as far as the mutual inductance of one on the other is concerned, are replaced by very small conductors located at the center of the strands of the cable. Considering a magnetic conductor a slight modification in the above formulas must be made, namely, the permeability factor μ must be introduced into the term for the internal inductance. The following formulas would then apply.

For a seven-strand cable,

$$L = \frac{1}{49}(98 \log_e \frac{s}{r} + \frac{7\mu}{2} - 24 \log_e 2 - 60 \log_e 2 - 12 \log_e 6) \text{ per cm.}$$

For a three-strand cable,

$$L = 2 \log_e \frac{s}{2.153r} + \frac{\mu}{6} + 2 \log_e \left(\frac{2\sqrt{3+3}}{3}\right) - \frac{4}{3} \log_e 2 \text{ per cm.}$$

The terms involving the mutual inductance of the wires are not affected since the medium separating the strands, the zinc galvanizing, has a permeability of unity. These formulas are fairly accurate as long as the skin effect is practically negligible. For small wires, below No. 14, this condition holds. For large size, however, an error is introduced.

The data for the permeability curves were obtained by solving the above equations for μ. The permeability

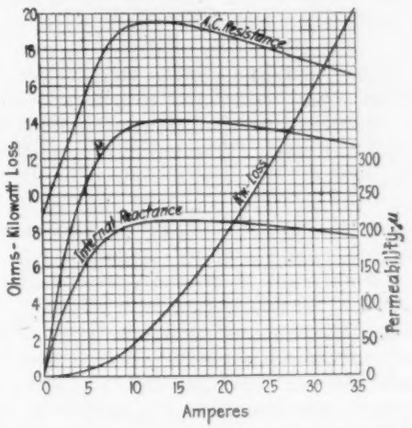


FIG. 4—CONSTANTS FOR ONE MILE OF NO. 6 B.W.G.-B.B. SOLID GALVANIZED IRON WIRE AT 60 CYCLES AND TEMPERATURE OF 20 DEG. C.

for the No. 6, B. W. G. B. B. solid galvanized iron wire of Fig. 4, was obtained by substituting test data in the following formula taken from the Standard Handbook for Electrical Engineers (fourth edition, Article 77, Section 2):

$$L = 0.1403 \log_{10} \frac{D}{r} + 0.01524\mu,$$

in millihenrys per 1000 ft.

In lieu of other data, these permeability curves may be used to compute with a fair degree of accuracy the inductance of other sizes of cables of the same material. Particular attention is called to the fact that current density must be used as a basis for com-

*Reactance of Stranded Conductors, by H. B. Dwight, ELECTRICAL WORLD, Vol. 61, No. 16, page 828.

TABLE I—COMPARATIVE STEEL AND COPPER TRANSMISSION LINE COSTS

GENERAL CONDITIONS AND ASSUMPTIONS

Conductor: Steel—5/16 in.—seven-strand ordinary grade galvanized. Copper—No. 6 H. D. copper, 96.2 per cent conductivity.	
Length of line	10 miles
Useful life of line	Twenty years
Number of phases	Three
Length of span	Same for both cases
Salvage value of copper	8 cents per pound
Salvage value of steel	None
Cost of power	0.5 cents per kilowatt-hour
Interest on investment	5 per cent
*Cost of stringing wires (three wires) per mile of line: Steel weight per single conductor, 1107 lb.; per mile	$53.50
Copper weight per single conductor, 20 lb.; per mile	$26.20

STEEL CONDUCTORS		COPPER CONDUCTORS	
Fixed charges:			
30 miles of wire at $70 per mile	$2,100.00	30 miles No. 6 H. D. copper at 36 cents per lb	$4,536.00
Stringing wire at $53.50 per mile of line	535.00	Stringing wire, three conductors at $26.20 per mile	262.00
Interest on investment at 5 per cent, twenty years	2,635.00	Interest on investment at 5 per cent, twenty years	4,798.00
Total	$5,270.00		$9,596.00
		Less salvage value at 8 cents per pound	1,008.00
			$8,588.00
Variable charges		Variable charges	
Energy loss twenty-four hours per day, 360 days per year at 0.5 cent per kilowatt-hour.		Energy loss twenty-four hours per day, 360 days per year at 0.5 cent per kilowatt-hour.	
Line current 1 amp. (Resistance 5.51 ohms per mile)	142.75	Line current 1 amp	56.25
Line current 2 amp. (Resistance 5.58 ohms per mile)	578.90	Line current 2 amp	225.00
Line current 5 amp. (Resistance 5.72 ohms per mile)	3,706.55	Line current 5 amp	1,406.25
Line current 7 amp. (Resistance 5.8 ohms per mile)	7,366.45	Line current 7 amp	2,756.25
Line current 10 amp. (Resistance 5.95 ohms per mile)	15,422.20	Line current 10 amp	5,625.00
Total cost at end of useful life of line:		Total cost at end of useful life of line:	
Line current 1 amp	$5,412.75	Line current 1 amp	$8,644.25
Line current 2 amp	5,848.90	Line current 2 amp	8,813.00
Line current 5 amp	8,976.55	Line current 5 amp	9,994.25
Line current 7 amp	12,636.45	Line current 7 amp	11,344.25
Line current 10 amp	20,692.20	Line current 10 amp	14,213.00

*Based on data used by Oregon commission.

parison. The relative size of wire with respect to the size for which curves are given has a direct bearing on the accuracy obtainable. The nearer the size of wire under consideration is to the size for which curves are given, the greater will be the degree of accuracy. The error is due to the fact that for the same current density the skin effect is not the same in different sizes of wire. An error would also be introduced because, as noted previously, iron and steel wire is not well standardized.

The resistance and loss curves were taken from test data, all values being corrected to a temperature of 20 deg. C. A temperature coefficient of 0.0053 was used both for iron and steel. The value of resistance given for zero amperes is the direct-current resistance corrected to 20 deg. C. These curves substantiate the results of other observers in that in each case the resistance and internal reactance increases with the current until a maximum is reached, when a further increase in current causes a decrease in effective resistance and reactance. The explanation lies in the fact that as the iron becomes saturated, the eddy current and hysteresis losses do not increase with an increase in current. It should be noted that the rate of increase of resistance is different for the different grades of wire, the softer grades showing the greater increase.

Selection of Iron Wire for Transmission Purposes

In the selection of an iron wire for transmission line purposes, a great many varieties present themselves for consideration. Other electrical factors remaining the same, the wire to be selected should have a high conductivity and a relatively low first cost. Table II gives the cost, resistance and area in circ. mil of the stranded wires, the constants for which are shown in Figs. 1, 2 and 3. In order to compare them on a basis of equal area, the resistance of three strands of B.B. galvanized iron of an area equal to the seven strand cables was computed. In view of the fact that the resistance of grade B.B. wire increases more rapidly than the resistance of ordinary grade steel, it is evident that of the three wires enumerated in the above table, the ordinary grade steel would be the most economical if first cost, operating cost during the life of the wire, etc., are taken into consideration.

TABLE II—COST, RESISTANCE AND AREA IN CIRC. MILS OF STRANDED WIRES CONSIDERED

Material	Area in Circ. Mil	Direct-Current Resistance per Mile	*Cost per Mile
Three-strand B. B. galvanized iron	83,167	4.78	$103.00
Seven-strand Siemens-Martin galvanized steel	83,167	7.41	95.60
Seven-strand ordinary grade galvanized steel	83,167	5.51	79.20

*Pacific coast prices.

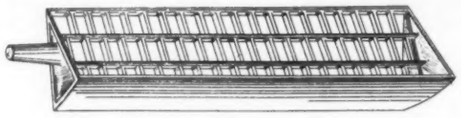
Taking up the feasibility of using iron wire in place of copper for transmission and distribution from an economical standpoint, several factors bearing on the question must be given consideration. It is obvious that the outstanding factor which might make the use of iron wire possible is the difference in the first cost. In addition to this, a careful investigation of the probable difference in operating expenses should be made. This is an uncertain factor in that it involves the length of time the line would be in service. Here again, several conditions may be met which would affect the useful life of the line. Growth of the connected load may be so rapid that the line selected would prove inadequate in a few years. The life of an iron or steel wire is shorter than for copper cables, especially near the seacoast or where smoke, the gases from blast furnaces, etc., may be encountered. Other factors which have a bearing on the subject are the interest on the investment for the two cases, the difference in the cost of stringing wire and the salvage value after the line has been withdrawn from service. Because of the many variables entering into a case of this nature, no absolute rule can be followed. Each case is in itself a special problem and must be so considered. However, for the purposes of illustration, an assumed set of conditions is taken and examples of a copper and steel line worked out on these assumptions. In order to make the case general, instead of assuming different load conditions to eliminate the voltage factor, a number of values of line current have been assumed and examples worked out on that basis. The assumption is also made that the load requirements are such that a copper wire smaller than a No. 6 cannot be used for mechanical reasons.

From a study of data such as given in Table I for a given set of conditions, the load which can be economically carried by an iron or steel line may be readily determined. In general it can be said that steel conductors can be used economically at the prevailing prices for the transmission of small loads where a copper conductor having the necessary conductivity would not meet the mechanical requirements. The steel conductor has also the advantage that its greater mechanical strength permits a longer span, providing of course that no appreciable increase in load is contemplated, otherwise the length of span must be such that ultimately a copper conductor may be substituted.

The tests referred to in this article were conducted at the Oregon Agricultural College, Corvallis, Ore., and the authors take this opportunity of expressing their appreciation for the assistance rendered in the preliminary work by the various members of the senior class and to the instructional staff for their kindly criticisms and suggestions.

Storage Battery Grid

George Leonard and George John Fuller propose a new type of grid, which when the cell is built up, is completely incased or externally armored with continuous or unperforated lead and its disintegration completely prevented owing to the manner in which it is supported. In patent No. 1,197,816 there is illustrated a construction in which each electrode comprises a core of lead on which the active material is pressed.



CONSTRUCTION OF BLOCK ELECTRODE

The adjacent faces of the electrode are insulated by wood so that all possibility of the peroxid or other active material getting dislodged and falling to the bottom of the cell is prevented even on its exposed surfaces. It is claimed that the block electrode can be subjected to rough handling, short-circuited or reversed or allowed to stand idle in a discharged state without appreciable deterioration, as the electrodes cannot buckle or disintegrate owing to their construction.

Operating a Station Under Unfavorable Conditions

Method of Cleaning Boilers, Treating Feed Water, Manipulating Fires, Relaying Engines and Using Exhaust Steam Together with Operating Expenses

PLANT performance data as usually published represent record operation of large plants with new equipment or results of special tests. The results secured from standard and special apparatus in regular service and under usual conditions are of equal value from the standpoint of permitting interpretations and comparisons by operators in small plants where the most favorable conditions cannot always be approached. The data presented in what follows represent the performance of a private generating plant operating under relatively unfavorable conditions where there was little opportunity to develop the load, as can usually be done by a central station. The operator has directed most of his efforts toward reducing maintenance expenses to compensate for the high operating cost attending the poor load factor. The plant referred to was put in operation in the fall of 1912 by the Pennsylvania Railroad to furnish energy for heating and lighting its Cortlandt Street ferryboat terminal in New York City and for operating mooring winches, bridge hoists and hauling winches.

EQUIPMENT OF BOILER PLANT

The equipment is peculiar for a stationary plant in that locomotive type boilers are used. Duplicates are installed and operated alternately, each being rated at 125 hp. at 125-lb. pressure and having 8 ft. 11⅞ in. by 4 ft. 7⅜ in. grates with crown sheets 4 ft. 11¼ in. above the grates. With fresh fires the fuel bed is maintained about 3 in. thick, but is allowed to attain 12 in. thickness just before cleaning, which is done every twelve hours in summer and every six hours in winter. Whenever thin dark spots appear in the fuel bed they are promptly covered. Pennsylvania standard pea coal

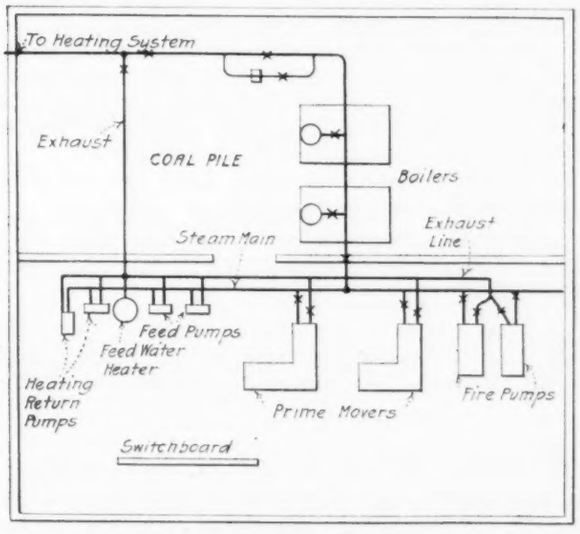


FIG. 1—ARRANGEMENT OF ENGINE AND BOILER ROOM EQUIPMENT

containing about 15 per cent ash is delivered to the station daily in carts from the company's supply at the Jersey City terminal across the river. The draft to support combustion is maintained by a round steel stack, 3.5 ft. in diameter and 78 ft. high. This is connected with both boilers by a yoke. A 0.25-in. draft has been found sufficient to carry the load in summer and a 0.5-in. draft in winter, the proper value being maintained by a Locke damper regulator.

Once a month the boiler stay bolts are tested. In addition the units are subjected to pressure tests made by city inspectors. Every week the tubes are cleaned and once every twenty-four hours the boilers are blown down, the former being done with a steam blast while

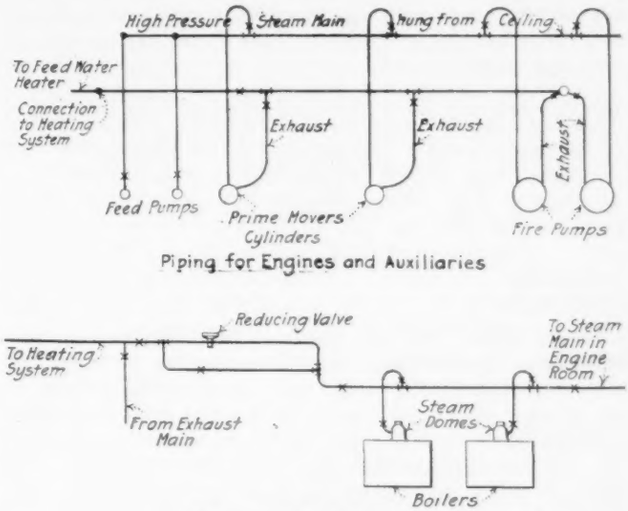


FIG. 2—PIPING LAYOUT FOR ENGINE SUPPLY AND HEATING SERVICE

the fires are burning. No tubes have had to be replaced since the boilers were installed. This is probably due to the care with which the fires have been handled, the thorough washing that each boiler receives after being shut down and the treatment that the make-up water receives.

METHOD OF CLEANING FIRE TUBE BOILERS

Since the boiler tubes are staggered, it has been considered advisable to flush them with water after shutting them down, about 500 cu. ft. being used for this purpose. Following this 25 lb. of sal soda and 2 gal. of kerosene are dumped into the boiler, which is then filled with water at about 210 deg. Fahr. Each boiler holds about 2800 gal. The solution is allowed to stand for about ten days, after which it is raised to boiling temperature and the kerosene vapor allowed to escape to the atmosphere. Then the surface water is blown off to remove suspended matter and remaining kerosene before the boiler is restored to service. The operator has found that kerosene is especially serviceable in cleaning the boilers, because it works under any scale which may be present and loosens it. Every week approximately 10 lb. of sal soda is fed into the injector supply line to clear the pipes and remove any deposit which may have formed in the feed pipe discharge. Less sal soda is required in winter because most of the boiler feed consists of condensate returned from the heating system.

The generating equipment consists of two 250-125-volt, 100-kw. Westinghouse generators direct connected to 150-hp. Harrisburg-Fleming four-valve engines. The guaranteed steam consumption of these engines and the efficiencies of the generators are given in Table I.

The engines are run alternately, each operating twenty-four hours continuously. Rochester automatic lubricators oil the cylinders, while other parts are lubricated by cup or can.

CHARACTERISTICS OF SUMMER AND WINTER LOAD

During the summer the average day load is only 11 kw. and the night load is 46 kw. without motors running. When the latter start, the day load occasionally jumps to 66 kw. For July, an average summer month, the energy consumption is about 12,600 kw.-hr., and for December, a typical winter month, the corresponding figure is 14,100 kw.-hr. Among the purposes for which energy is used are: Illuminating the waiting-room and offices over same, lighting two large signs and operating three mooring winches, three bridge hoists and three hauling machines. Two steam fire pumps are also operated.

TABLE I—ECONOMY OF ENGINES AND EFFICIENCIES OF GENERATORS

Percentage of Rated Load	Pounds Steam per Indicated Horse-power	Efficiency of Generator
50	31.7	89.5
75	29.6	90
100	29.2	90

In the winter exhaust steam is used for heating two buildings. A reducing valve is connected between the high pressure steam mains and the heating system so the exhaust steam may be supplemented with live steam to make up for the deficiencies of the exhaust. During the summer, in the daytime, about 15 per cent of the exhaust steam is utilized in heating feed water. At night, about 75 per cent is released to atmosphere.

The feed-water heater is of the Cochrane atmospheric

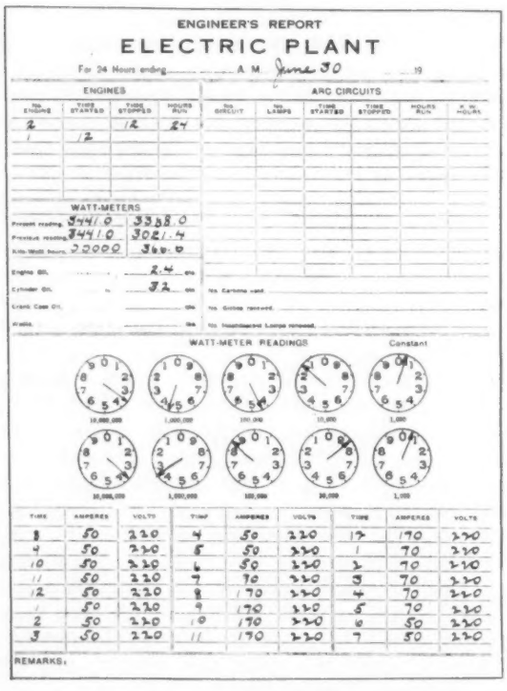


FIG. 3—TYPICAL ENGINEER'S LOG SHEET

pressure type, equipped with a relief valve which permits all surplus steam to discharge into the atmosphere. Caring for the boiler feed on a summer day when the generator was carrying an 11-kw. load the water inlet temperature was 70 deg. Fahr. and the outlet 210 deg. Fahr. Under these conditions the 6 by 4 by 6-in. Worthington duplex boiler feed pump was operating twenty-four strokes a minute. Once a year coke is placed in the bottom of the feed-water heater to collect scale. The circulation pump is used only in winter for drawing back condensate from the heating system. The two fire pumps which are 14-in. by 7-in. by 12-in. Buffalo

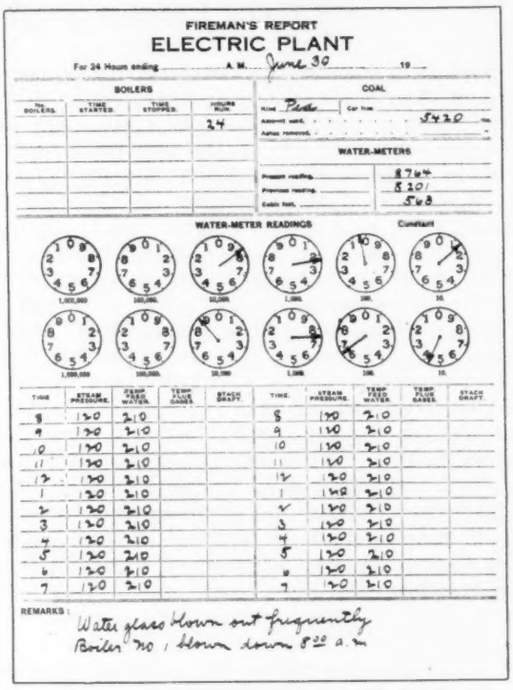


FIG. 4—TYPICAL FIREMAN'S LOG SHEET

units rated at 500 gal. a minute are operated alternately, being kept in motion all the time, but at slow speed.

OPERATING EXPENSES

Two engineers and two firemen are required to operate the plant. In July the daily coal consumption is about 5978 lb., while the monthly consumption is 183,340 lb. About double this amount is required in winter. About twenty-five drops of 600 W. vacuum oil is used per minute for cylinders. Lubricating oil is used over and over, there being about 5 per cent depreciation. Fifty pounds of waste is used per month. In summer, about 20,000 cu. ft. of water is used per month, of which 500 cu. ft. is used each time boilers are flushed and some is used for sanitation.

The yearly expenses, including labor and material, are approximately as follows:

Boiler repairs and maintenance	$64.56
Auxiliary repairs and maintenance	10.49
Prime mover repairs and maintenance	37.21
Generator repairs and maintenance	...
Miscellaneous (packing, supplies, etc.)	42.87

J. A. Hanna is chief engineer of the plant, but C. B. Keiser, who is master mechanic of the Pennsylvania Railroad Company, has supervision of general affairs.

An Automatic Extinguishing Arc Lamp

An arc lamp is suggested for street lighting in which a plurality of regulating magnets is employed for extinguishing some or all of a series of lamps at a given hour or causing such lamps to burn with diminished brilliancy. The inventor, Wilhelm Dietz of Germany, obtains his automatic control by momentarily changing the strength of the current in the circuit. This abnormal current causes the carbon feed regulator directly or indirectly to close a circuit which permanently affects the strength of one of the magnets.

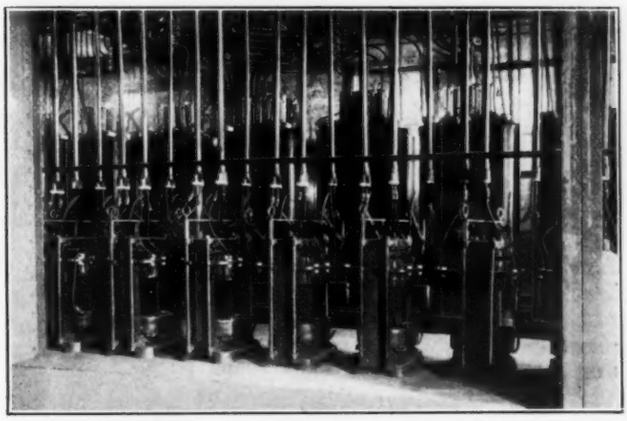
The patent, No. 1,191,289, is controlled by the Körting Mathiesen Aktiengesellschaft of Leipzig, Germany.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Arrangement of Conduit Wiring for Tub Transformers

The compact wiring installation shown in the accompanying illustration is a feature of the constant-current transformer bank in a Canadian plant. The leads to each "tub" are carried vertically through conduit pipe and condulets to insulated couplings mounted immediately above the casings of the various units, the lower portions of the conduits being clamped to a horizontal stiffener bar carried between two adjacent columns.



ARRANGEMENT OF LEADS TO TUB TRANSFORMERS

The arrangement provides ample walkway space for operators on the concrete floor of the station basement behind the tubs, and avoids the inconvenience of projecting leads at the front of the various sets.

Transmission Company Uses Morse Code to Supplement Telephone Service

BY H. L. PATTERSON

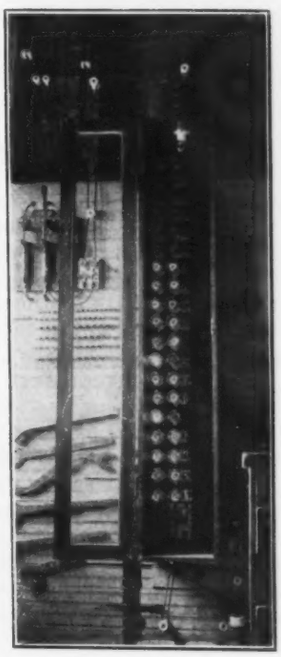
In connection with the operation of a 110,000-volt steel tower transmission line between Blewetts Falls and Raleigh, N. C., a distance of about 100 miles, the Yadkin River Power Company employs an interesting combination of the telephone and the telegraph. The main generating station for the system is located at Blewetts Falls and the load dispatcher is stationed at Raleigh. From time to time some difficulty has been experienced in maintaining satisfactory communication between these two points, due to noisy telephone transmission over the telephone circuits carried on the transmission line towers. The peak load for the system is very large and picks up and drops off rapidly three times a day, in the morning, at noon, and at night, due largely to the heavy cotton mill load. At such times particularly the dispatcher often has experienced considerable difficulty in maintaining proper voltage conditions at Raleigh on account of the poor telephone transmission. For this reason serious consideration was given to the rebuilding of the telephone line some distance from the power line or the leasing of a line from the telephone company before the use of the Morse code was decided upon.

The arrangement by which the Morse code is employed consists in using a telephone conductor as a telegraph line, with telegraph instruments installed at each end of the line. The Morse code is now used during the time of peak loads when the voltage changes, and load changes are rapidly signaled by the dispatcher and received by the operator with a decided saving in time over calling the operator to the telephone, with frequent delays due to confusion of telephone signals.

It has been found that the station operators master the Morse code in a surprisingly short time, and in many cases become sufficiently expert to send long messages by means of the telegraph, and conduct all necessary routine communication between the two stations mentioned in a prompt and satisfactory manner. The writer knows of several times, especially during storms, when the telephone line was out of commission and it required several hours to get it in working condition again, that the telegraph has prevented operating complications.

Home-Made Water Level Indicator with Automatic Signals

In each of the two water-power plants of the Boardman River Electric Light & Power Company at Traverse City, Mich., a very unusual and efficient home-made water level indicator is installed which not only shows the level of the water in the forebay at all times, but also automatically closes a circuit through a warning bell whenever the water reaches any predetermined upper or lower limit at which it may be desired to change the gate opening. It thus insures keeping the water level within the best operating limits without requiring any attention on the part of the operators.



INDICATOR WHICH AUTOMATICALLY GIVES ALARM FOR HIGH AND LOW WATER OPERATING LIMITS

The device consists of a double row of nineteen low-wattage lamps connected through nineteen double-throw, single-pole switches to as many contact points in a mercury column in the forebay. The height of the mercury column is, of course, regulated by the water pressure or head, and as all lamps of each vertical row are in series, all lamps below the highest point through which the mercury column completes the circuit are thus lighted and indicate constantly the height of water between a head of 11 ft. and of 14 ft. by 2-in. jumps. The head in feet and inches may be read on the red and white cards be-

side the lamps, the feet marks being on red cards and the others on white ones.

The alarm system is regulated for the different heads by closing the small double-throw switches mounted in the cabinet at the right of the lamps as shown in the illustration. For the upper limit signal, the switch is thrown toward the lamp. This puts the alarm bell in series with the left one of the pair of lights opposite, and when the mercury column comes up to the contact point and completes the circuit through this lamp, the bell rings and notifies the men that the gates need attention.

For the lower limit signal, the switch is thrown to the right pole. This cuts a thermostat in parallel with the right lamp opposite, and when the water level recedes to the point that the mercury column opens the circuit through the lamp, the current through the thermostat is also cut off. The thermostat then cools off and closes a circuit through the alarm bell. The thermostat is made use of in one station, and in the other a magnet is used instead, the armature closing the circuit through the bell when current is off.

The device is particularly useful at the upper station since the forebay is about 400 ft. away from the plant, making any but an electrical indicator rather unsatisfactory. At the lower plant the station is right at the forebay, but the automatic features make the device valuable in maintaining sufficient flow of water below the dam to satisfy the government requirements at all times.

At the time this picture was taken the water level was at 13 ft. head as indicated by the lighted lamps. The high mark alarm switch was closed for 13 ft. 2 in. and the lower alarm switch was closed at 12 ft. 2 in., as shown by the dimmer light opposite the latter marking, and the position of the switch in both cases.

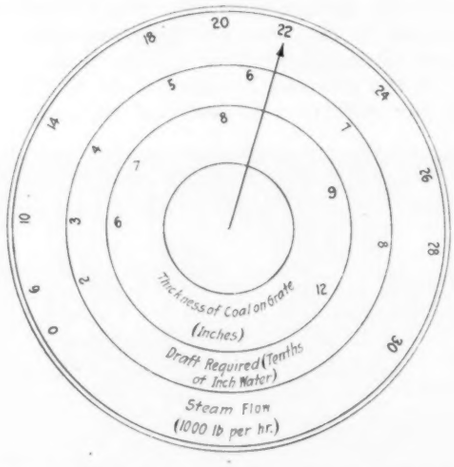
Calibrating Steam Flow Meters to Show Drafts Required

BY R. I. ELKIN

For the most efficient and effective firing of boiler furnaces, firemen should know their outputs, the amount of fuel required at various loads, and the quantity of air necessary for the complete combustion of fuel at different loads. This information can be indicated automatically by equipping steam flow meters of the indicating type with two additional scales, one indicating the thickness of the fuel bed and the other the required draft in tenths of an inch. These scales should be calibrated for the conditions at hand, and should be checked up periodically, because the relations between output, amount of fuel required and quantity of air necessary for combustion vary with changes in grade of fuel, variations in air leakage, changes in the friction of air passages, and the like.

The proper relation between the scales can be obtained by performance tests. For instance, it can be found what rate of combustion is required to produce a certain evaporation under the best conditions. The steam flow scale can then be used to indicate the rate of feeding the coal. There remains only one variable to be considered, namely, the rate of air supply. Within the limits of practical accuracy, it is not very objectionable to suppose that the infiltration of air through the boiler settings, doors and the like is a constant factor in the average installation.

Furthermore, the cross-section of the air ducts can be assumed to remain the same. Although the specific gravity of air is a function of temperature, it is not absolutely necessary to allow for this, except possibly by two corrections, one for winter and the other for summer. Since the quantity of air for combustion depends upon the velocity and weight of the air, and since the latter has been assumed fixed, it only remains to determine the velocity of the air for all rates of combustion as indicated by the flow meter. The usual way of indicating the velocity in a boiler room is to express the draft in terms of the thickness of the fuel bed. This relation is not difficult to determine, since it may be ascertained by direct measurement by means of duplex draft gages or by indirect means. The greatest care should be taken, however, that the tests are sufficiently extensive and of frequent occurrence to be really typical of conditions. The dial of a General Electric indicating flow meter equipped with three



THREE-SCALE STEAM FLOW METER SHOWING DRAFTS REQUIRED AT DIFFERENT LOADS

scales which have been calibrated as explained above is shown in the accompanying illustration. It should be pointed out, however, that the relation between the scales holds only for the conditions existing in the plant where this instrument is used. Each case must be considered separately.

The use of a meter calibration as indicated has the advantage that it indicates values that the average fireman can understand. It must be remembered, however, when the quality of the coal changes the meter requires recalibrating. Furthermore, it gives no indication as to deleterious influences that may be at work, as does the CO_2 recorder. While this three-scale indicator is not completely automatic, it is based on ideal boiler performance tests, and therefore gives the fireman a standard to work to. When the initial tests are made by experts in boiler performance and the fireman lives up to them, better results will accrue than if the method of firing is left to the individual judgment of each fireman.

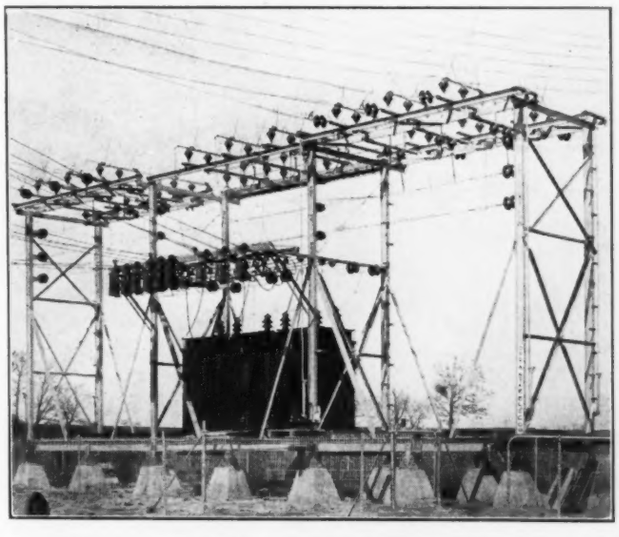
Arrangement and Cost of a 22,000-Volt Outdoor Substation

On the lines of the Lehigh Navigation Electric Company, South Bethlehem, Pa., there is in operation an interesting outdoor substation consisting of three 22,000/2300-4000-volt, 25-cycle, 300-kva. transformers and the switching equipment for several distribution lines. As shown in the accompanying illustration, the frame supporting the switching and protective equipmentment is divided by columns into three similarly shaped sections. In the center section the transformers with the primary and secondary switching and protective apparatus have been installed. The sections on

each side are devoted to high-tension switching equipment. Owing to the design of the structural framework and arrangement of circuits two additional banks of transformers can be accommodated in the end section of this substation when conditions are such as to require them.

Two 22,000-volt transmission circuits enter and leave this station, air-break switches being installed in their circuits so that either may be joined with a transverse bus connected with the transformer primary switches. These busbars are arranged in a vertical plane, being strung between strain insulators attached to the end columns and supported at intermediate points by pin-type insulators attached to the columns in an inclined position. The 22,000-volt circuits leading to the transformers are equipped with three-pole air-break switches, choke coils, chemical fuses and graded-resistance, high-speed, sphere-gap lightning arresters. From the choke coils jumpers lead to a lower set of busbars. These are arranged in a horizontal plane to permit connecting the high-tension transformer windings in delta. All of the air-break switches are connected by link work with vertical operating rods extending down the substation columns.

The 2300-4000-volt terminals of the transformers lead to disconnecting switches, thence through chemical fuses and choke coils, to the outgoing lines. The lightning arresters protecting the 2300-4000-volt circuits may be seen installed on the rack in front of the transformers. Three low-voltage circuits now leave the substation. The entire substation is elevated on concrete pedestals and surrounded by a fine-mesh wire fence. All steel and malleable-iron parts of the tower, switch and control equipment are hot galvanized. The steel framework, high-tension and low-tension switching equipment, choke coils and fuses were furnished by the Delta-Star Electric Company. The low-tension arresters are of the Garton-Daniels type, and the transformer units were furnished by the Westinghouse Electric and Manufacturing Company.



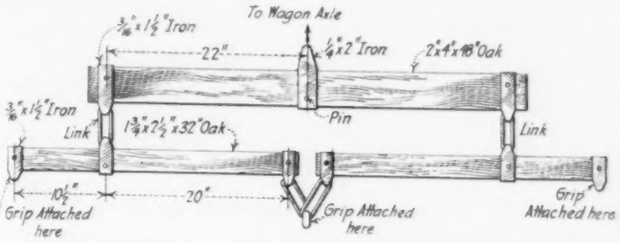
OUTDOOR SUBSTATION OPERATED BY LEHIGH NAVIGATION ELECTRIC COMPANY

The cost of the central section of the substation was as follows: Material $4.33 per kilovolt-ampere, and labor 55 cents per kilovolt-ampere, making a total of $4.88 per kilovolt-ampere. Approximately half of the labor expense is attributable to hauling transformers a considerable distance over rough roads. When the substation rating is increased the unit cost of the complete equipment will be correspondingly less than that of the initial or center sections.

Method of Stretching Three Line Wires at One Time

BY H. H. FENTON

When constructing three-phase transmission lines a great waste of time is often caused in stretching conductors by the awkwardness of the block and tackle method. To eliminate this waste of time the writer employs a scheme which enables a small force of men to stretch all three conductors of a three-phase line in one operation. In other words, the three conductors are strung, stretched and tied in with one trip over the ground and by climbing up each pole once. To facilitate stretching all three wires at once a special



SPECIAL WHIFFLE-TREE FOR STRETCHING THREE LINE WIRES AT ON ETIME

whiffle-tree constructed as shown in the accompanying illustration is used. This device and a crew consisting of a foreman, four climbers, a team with driver and a helper on the wagon to watch the reels and fasten the wire grips, can handle line construction rapidly and without difficulty.

The main beam of the special whiffle-tree is made of oak, 2 in. by 4 in. by 48 in. long. The single-trees are also of oak, 1¾ in. by 2½ in. by 32 in. long. A clevis, ¼-in. by 2-in. iron, fits the main beam at its center and is held by a pin. Two other clevises are of 3/16-in. by 1½-in. iron, one placed at each end of the main beam on 22-in. centers. Six other clevises are made of the same stock and fit the ends of the single-trees. The spacing is shown in the diagram. The links used with the clevises are made of ⅜-in. round iron. This special device is attached to the axle of the wagon by a chain so that it drags about 2 ft. behind the rear wheels. Three reels are mounted upon the wagon platform and carry the wire.

When stringing the conductors for a particular line, each conductor is dead-ended at the starting point and the team driven six spans for the first pull. Each climber takes his assigned place, one at a pole, the foreman making the fifth, and each carries the wires up the pole, the helper meanwhile at the wagon making fast the wire grips on the conductors, thus attaching the special whiffle-tree to them. The driver then starts the team and draws the wires taut. The brake is then applied on the wheels of the wagon to aid the team in holding the strain. After the four climbers have tied in the line the grips on the special whiffle-tree are released and the team driven up four spans, thus unreeling wire for another pull and the cycle of operation is repeated. Four spans have been found about the maximum pull on an upgrade that can be made with one team of horses; however, on a downgrade as high as seven spans have been stretched without any difficulty at one pull.

This method of construction makes possible a very taut line, does not produce twisting upon any pole, makes all wires hang alike, and is considerably faster than the block-and-tackle method. An average of 3 miles of three-phase line has been strung, stretched and tied-in in one day.

Procedure When Charging Lightning Arresters

The Consumers' Power Company, Jackson, Mich., according to its official organ, considers that aluminum-cell lightning arresters should be charged at least once every twenty-four hours, and then for at least five seconds. In extremely hot weather, or if arresters are installed where temperature is excessive, they should be charged twice a day. If arresters are too hot, and need charging more than once a day, the condition will be indicated by an increase in the charging current arc and charging current from day to day. When arresters are in good condition, the charging current should be approximately 0.25 amp. on 30-cycle circuits and 0.4 amp. on 60-cycle circuits. It is important that the charging should be done at a time when the line voltage is at its highest value. The following procedure is suggested by this company for charging arresters. First, close the gaps for five seconds with a quick, positive motion; second, open gaps wide; third, reverse transfer switch; fourth, close gaps again for five seconds; fifth, open gaps wide; sixth, set transfer switch in normal position; and seventh, set gaps in normal position. When charging, the gaps should be actually closed.

Useful Diagrams for Computing Sizes of Cross-Compound Pumping Engines

The accompanying charts, which have been compiled by the engineering department of the Allis-Chalmers Manufacturing Company, make it possible to quickly determine the size of pumping engines that will meet particular requirements. By means of chart No. 1, the diameters of cylinders can be obtained, and from chart No. 2 the length of stroke and floor area.

To illustrate the use of the chart the following conditions will be assumed: Capacity, 10,000,000 gal. a day; total head in feet, 200; piston speed, 250 ft. per minute; steam pressure, 140 lb. Starting in the upper left-hand square with the capacity (10,000,000), follow this line vertically until it intersects the head in feet (200), then continue horizontally to the diagonal line marked with the piston speed (250), from which drop to the steam pressure line marked (140). Horizontally opposite is the low-pressure cylinder diameter (50 in.). Where the horizontal line intersects the diagonal (140) is the high-pressure cylinder diameter (24 in.).

With the information secured in this way the stroke and floor space can be obtained from chart No. 2. For example, starting in the upper left-hand square with the low-pressure cylinder diameter (50), trace vertically to the line marked with the high-pressure cylinder. Horizontally opposite this point is the width of the pump in feet (16 ft. 3 in.). Continuing to the steam pressure diagonal (140), and then dropping to the horizontal scale, will give the stroke in inches (36 or 42).

The length of floor space required is obtained by starting with the low-pressure diameter (50) on the lower left-hand chart, following the vertical line to the stroke (36), thence tracing the horizontal line to the diagonal marked with the capacity (10,000,000), and dropping vertically, where the length (36 ft.) is given. The piston-speed of 250 ft. per minute, and stroke (36 or 42) determines the revolutions per minute.

It might be pointed out in this connection that the duty of a plunger pump will remain approximately the same under change in head or capacity, dropping only 8 per cent of normal with one-half normal speed, 2 per cent with three-quarters speed, and 2.5 per cent with one and one-quarter normal speed. With one-half normal head the duty drops only 9 per cent of normal, at three-quarters head less than 1 per cent, and at one and one-quarter normal head about 7 per cent.

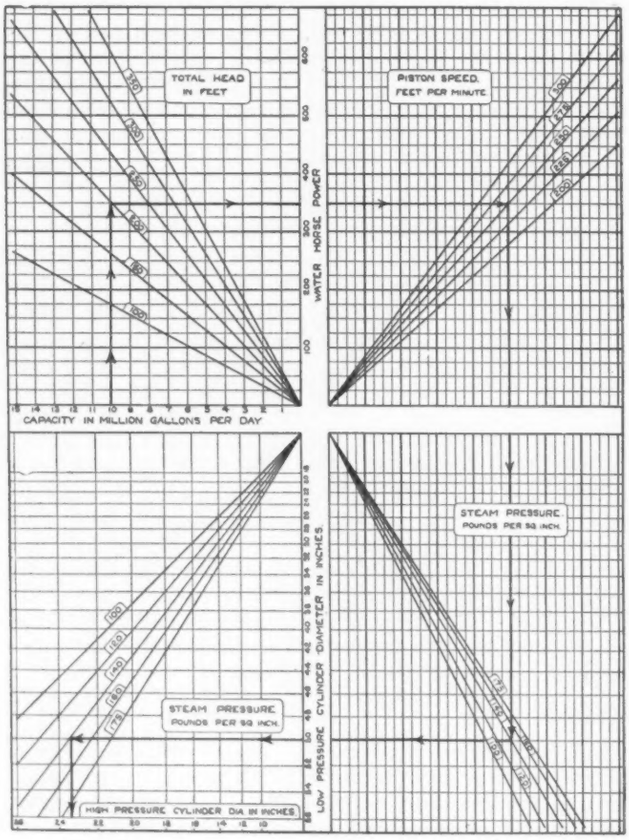

TOTAL HEAD IN FEET
PISTON SPEED FEET PER MINUTE
WATER HORSE POWER
CAPACITY IN MILLION GALLONS PER DAY
STEAM PRESSURE POUNDS PER SQ INCH
HIGH PRESSURE CYLINDER DIA IN INCHES
LOW PRESSURE CYLINDER DIAMETER IN INCHES

FIG. 1—CHART GIVING HIGH- AND LOW-PRESSURE CYLINDER DIAMETERS FOR CERTAIN PUMP DUTY

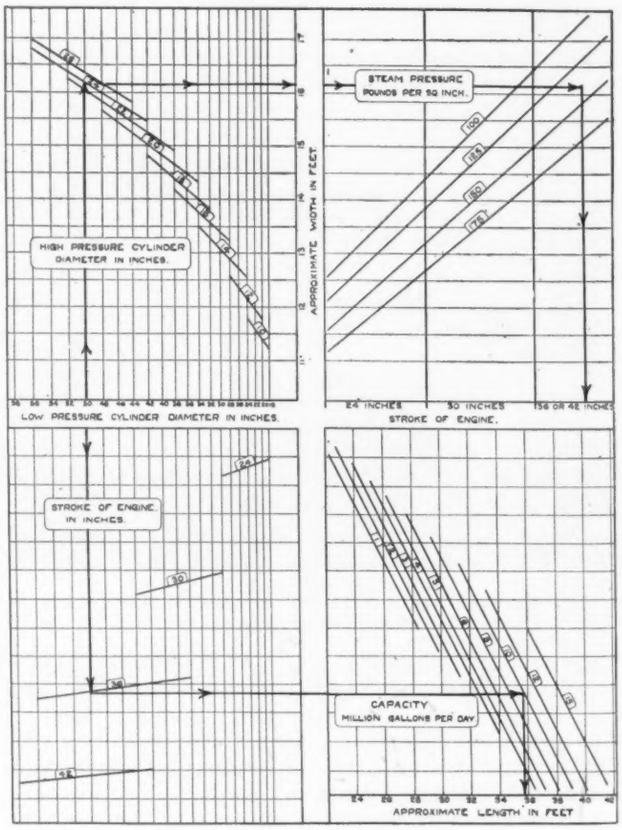

HIGH PRESSURE CYLINDER DIAMETER IN INCHES
APPROXIMATE WIDTH IN FEET
LOW PRESSURE CYLINDER DIAMETER IN INCHES
STEAM PRESSURE POUNDS PER SQ INCH
STROKE OF ENGINE
STROKE OF ENGINE IN INCHES
CAPACITY MILLION GALLONS PER DAY
APPROXIMATE LENGTH IN FEET

FIG. 2—CHART GIVING STROKE AND FLOOR SPACE OF CROSS-COMPOUND PUMP UNDER DIFFERENT CONDITIONS

COMMERCIAL AND BUSINESS POLICY

A Department of Plans and Methods for Widening the Application of Electricity and for Extending Electric Service

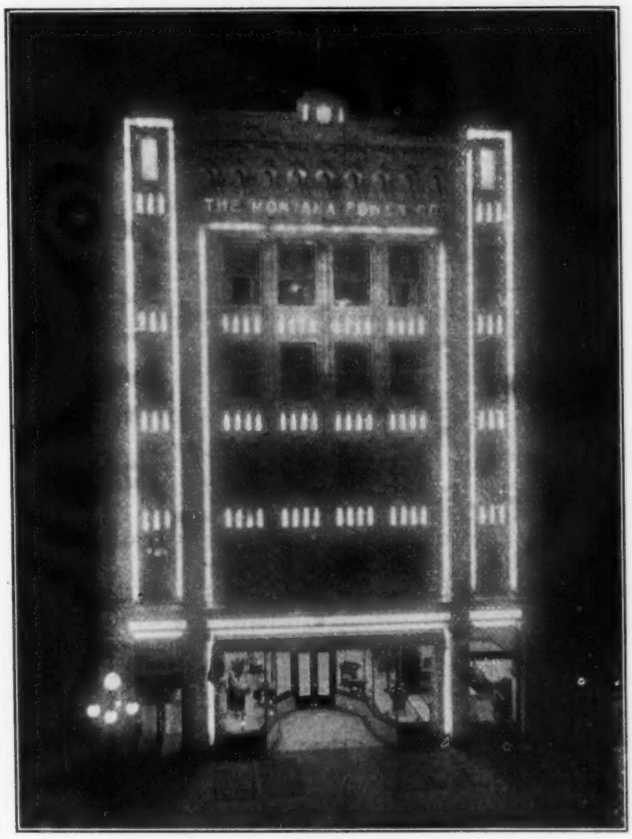
NOVELTY IN FAÇADE LIGHTING

The Illumination of the Billings (Mont.) Office of the Montana Power Company—Glass Panels Simulate Marble by Daylight

The Montana Power Company has recently completed a five-story office building at Billings, Mont., which embodies several notable features, including the illuminated façade shown. Brick, terra cotta, and the special glass used in the illuminated panels are the materials which make up the front of the structure.

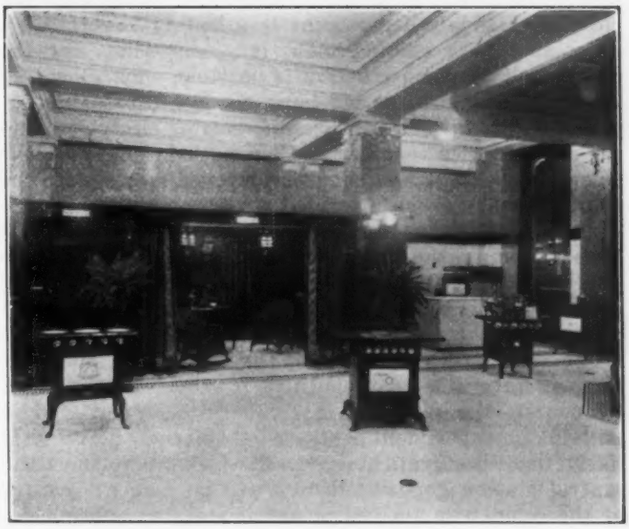
The offices of the company are on the first floor, and contain a spacious lobby, facing which is a completely equipped electrical kitchen. The mahogany office fixtures are grouped in a semi-circle around the lobby, making it possible to take care of a large number of customers at one time. By a well-planned arrangement of the front windows the electrically equipped kitchen attracts the eye of the passerby on the street, besides claiming attention from those in the lobby.

A well-appointed rest room forms a part of the lobby, although rich portières serve to set it off from the rest of the interior. The convenience of the customer is carefully provided for, the room being supplied with writing desk, telephone, mirrors, lavatory, etc. Special lighting fixtures which correspond with the ornamental plaster work add materially to the general effect.



MONTANA POWER COMPANY BUILDING AT BILLINGS

Original practice marks the exterior lighting of the building. The incandescent lamps behind the illuminated panels are mounted in galvanized-iron troughs 6 in. wide by 6 in. deep, the glass frontings being set flush with the building. A special quality of glass was obtained for the panels, and in daylight gives the appearance of a marble trim on the terra cotta. At night a very soft and pleasing illumination is obtained. Approximately 750 sq. ft. of this glass is used on the entire front of the building. This special glass, which was furnished by the Macbeth-Evans Glass Company, Chicago, cannot be cut, but must be sawed to shape when in process of manufacture.



DISPLAY ROOM IN NEW BILLINGS (MONT.) CENTRAL-STATION OFFICE

Gratis Repair and Conversion of Heating Devices That Pay Threefold Their Cost

A number of progressive central stations recognize the advantages of repairing customers' heating devices free of charge in order to keep them in service. One large company provides all its repair men with extra irons and extra cords with plugs already attached, so that the men can give immediate aid when a woman calls the trouble department to say, "My iron won't heat." There are, of course, some repairs which these men cannot make on the customer's premises. In such cases they are instructed to bring the defective device to the company's repair shop, where it is fixed and is immediately returned. For this service no charge is made.

The cost of performing this service for the company's patrons amounted to $18,000 last year, in spite of the fact that many heating elements are supplied free for renewal by device manufacturers. If this gratuitous service had been generally advertised the sum would have been much larger. But the amount expended represents the cost of calling for, repairing and delivering only those defective devices which customers called to the company's attention; presumably it represents in a large measure the repairs for which customers would

have been glad to pay. Such repairs the company has very willingly cared for during the last three or four years. It is not yet ready, however, to advertise this free service and thus to increase the scope of the work of its customers' service department.

Besides the gratis repair, the company is also beginning a certain amount of free conversion of gas and alcohol-heated devices which can be easily re-equipped for electric operation. Like the repair service, however, this work is not at present advertised. Whenever the company's repair department is asked to "electrify" a percolator or a chafing dish, it gladly sends for the device and, if reconstruction is possible, adds a heating element to replace the old burner.

Naturally, with each alcohol percolator electrified, and with each device repaired and put back into service, the company's load grows. Conservative estimates place the total annual revenue derived from repaired and re-equipped appliances at three and one-half times the cost of performing the free service, that is, $63,000. No one has yet tried to estimate the advertising value of this gratuitous service or its effect in creating a friendly attitude on the part of the customer. That the advertising value is great, and that the effect on public relations is favorable to the utility is, however, conceded. Of course, the plan is yet comparatively new and is still in an experimental state, but in the future it is likely that this gratuitous work, which really pays the central station good dividends, will be made a feature of the company's avowed policy of service.

Delivery Car for Use of Metermen

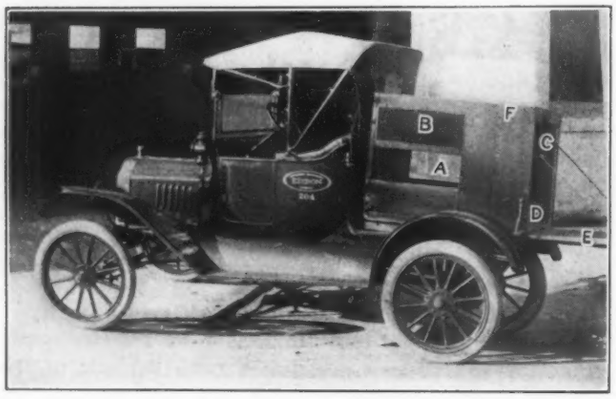
The Southern California Edison Company, Los Angeles, Cal., makes use of the light automobile with meter box shown for delivering meters to customers' premises. The box, which is of hard wood and is put together with screws and bolts, has been in use about a year, and has proven very satisfactory.

The compartments indicated by the various letters are used for the following purposes:

A is open on both sides and is used for carrying small coils of wire, small blocks of wood and other pieces of material found necessary at various installations.

B is a compartment with the doors opening on both sides of the car. This compartment is weatherproof, and circular loom and other material is carried therein.

C is divided into six sections, and contains hangers



AUTOMOBILE FOR DELIVERING METERS TO CUSTOMERS

on which are hung the meters to be set during the period of the day the car is in operation.

D indicates several drawers which contain screws, bolts and other material which must be confined.

E is the tail board which covers these various compartments shown in the rear, and which when dropped down forms a working table for the meter setter.

F is a space formed on top of the box by extending the side 3 in. above the top. Here there can be carried anything necessary that cannot be placed in any of the compartments.

This whole arrangement of compartments was first designed and the plans submitted to twelve meter setters on the system. The various suggestions made by the different men were then incorporated in the final box, which is shown in the illustration.

Brooklyn Edison "Easy Payment" Campaigns on Washers and Lamps

The Edison Electric Illuminating Company of Brooklyn conducted two special sales during the month of September, the results from which, according to T. I. Jones, general sales agent, were very satisfactory.

During September only the shop offered a $90 washing machine at $78, payable $6 on delivery of machine and the balance in twelve monthly installments of $6 each. Through the Edison shop and the branch offices 103 machines, totaling over $8,000 worth of washing machines, were sold. Each machine was delivered by the company's own truckman and was demonstrated on the customer's premises, so the commercial staff satisfied itself that the customer or the maid was familiar with all operations pertaining to the use of the machine. At the same time the company also conducted a campaign for outside lighting on 300-watt lighting units. The offer to the merchants was to install a 300-watt type C lamp complete with fixture and outer globe, supplying and installing the outrigger, necessary wiring to meter and patrol switch, for the sum of $12. This amount was payable $2 on the signing of the contract and $2 per month for five months. The lamps will be operated on the Edison company's flat-rate contract at $3.44 a month, the patrolmen turning the lamps on at dusk and off at midnight. Orders for 325 lamps were taken.

Promoting Electric Cooking Without a Cooking Rate

The Hunter Realty Company of Omaha, Neb., has recently bought fifty-seven electric ranges for a new sixty-three family apartment house. These ranges will be installed and operated in spite of the fact that the Omaha Electric Light & Power Company, from whose lines service is taken, has no cooking rate.

In order to make the use of ranges feasible under these conditions, the real estate firm has become a dealer in electric service. It contracted to take energy at wholesale from the central station company, and it will retail electric service to its apartment house tenants. The rate at which the energy is purchased follows a sliding scale schedule, in which the first 50 kw.-hr. per month cost 7 cents per kilowatt-hour; the next 50 kw.-hr., 6 cents; the next 100 kw.-hr., 5.5 cents; the next 100 kw.-hr., 5 cents; the next 100 kw.-hr., 4.5 cents; the next 300 kw.-hr., 4 cents; the next 500 kw.-hr., 3 cents; the next 2800 kw.-hr., 2.5 cents; the next 6000 kw.-hr., 2 cents, and all energy in excess of this amount 1.5 cents. This rate covers energy purchased for both lighting and cooking, provided the lighting does not amount to more than 20 per cent of the energy thus taken. The charge which the realty company makes against its tenant is grouped in one bill. Hence, the charge which a tenant receives as a bill for

rental really includes a $3 flat-rate addition for lighting and cooking and another similar charge for gas and heating, although it appears simply as a bill for rent.

In commenting upon the installation, James D. Hunter, secretary of the Hunter Realty Company, mentioned the success of Pacific Coast apartment house owners in the use of electric ranges, indicating that the news of the pioneer installations has produced telling results in real estate circles. He also said that he expected the ranges to help minimize decorating expense, and hoped that the flat-rate billing arrangement would solve other troubles for him.

It is said that the sale of these ranges marks an epoch in the electric range business in Omaha, for it is believed that there were only five or six other electric ranges operating in the city before this order was placed.

Company Show Windows Loaned to Local Merchants

At Middlesboro, Ky., and other places served by the Kentucky Utilities Company, the company makes a point of co-operating with the retail merchants of the city. Its office and display rooms are well located and the show window of the company is one of the best in town. Every other week the use of the window is given to one of the merchants of the city, the utilities company making use of the windows during the alternating weeks.

Driving the Time Honored Oil Lantern Out of Business

Twenty-three-watt tungsten lamps mounted in two series circuits of five lamps each have recently been used instead of time-honored oil lanterns for street construction sign service on Commonwealth Avenue, Newton, Mass. The lamps are mounted about 3 ft. apart horizontally and 16 in. apart vertically, as illustrated in the accompanying halftone, and energy is

TUNGSTEN LAMPS REPLACE THE OLD-TIME RED LANTERNS BURNING OIL

supplied from a 550-volt trolley circuit fed by a substation of the Boston Edison company. When mounted on a "horse" as shown, they serve effectively as a warning to automobilists on Boston's most popular driving street.

Wiring and Illumination

Latest Practice in the Electrical Contracting Field and in the Art of Interior and Exterior Illumination

Special Lighting of Downtown Chicago Street by Merchants' Association

The Monroe Street Improvement Association, Chicago, has completed a sixty-lamp street-lighting installation extending along Monroe Street from Michigan Avenue to Franklin Street, or entirely across Chicago's

ONE OF THE MONROE STREET LAMP STANDARDS INSTALLED BY LOCAL MERCHANTS' ASSOCIATION

loop district. Through co-operation with the city's electrical department, the existing lamps were moved or displaced to get the most effective combination of the twenty-two existing 445-watt flaming-arc and the sixty new 500-watt gas-filled tungsten-lamp equipments. Since the installation was made in accordance with the city's standard street-lighting plans it contains no new engineering developments.

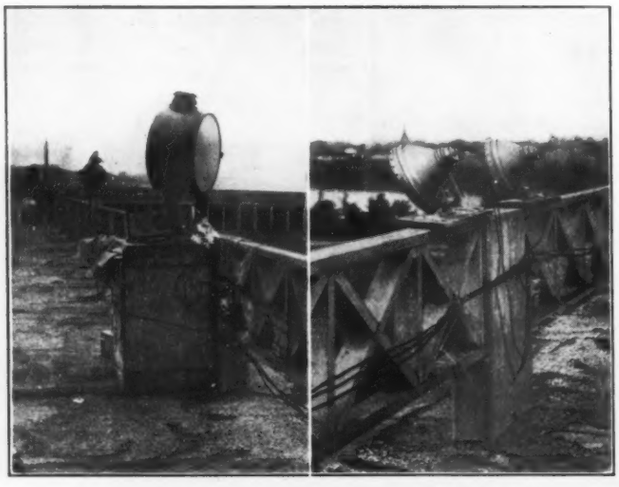
The 500-watt, 110-volt, straight multiple lamps are mounted in General Electric Form 6 fixtures suspended from tubular poles at a height of 25 ft. above the street. The poles are set on both sides of the street opposite each other on 100-ft. centers. At one point the elevated railway structure was utilized as a bracket support to avoid setting a pole. Direct-current energy for operating the system together with maintenance and removal service is purchased from the Commonwealth Edison Company under a five-year contract. The price

for this energy and service is $1.65 per week per lamp. Funds for operating the system as well as to cover the $6,000 spent in installing it were provided by assessing association members; for the installation property owners were assessed $1 per front foot and tenants were assessed 50 cents a front foot. An assessment of $1 a front foot a year is made against all property owners to pay the operating charges including the cost of electricity and maintenance.

Monroe Street is the second downtown Chicago thoroughfare to be lighted by a merchants' association. Dearborn Street was the first. Herbert A. Seward, who was consulting engineer for both jobs, said that the satisfactory increase in business resulting from the new lighting on Dearborn Street had very largely influenced the decision of the Monroe Street association.

Flood-Lighting the Harvard Football Practice Field

The Harvard Stadium at Allston, Mass., will soon be equipped with an installation of gas-filled lamps for flood-lighting in connection with 'varsity football practice. Dr. Louis Bell, consulting engineer, Boston, has



TYPES OF FLOODLAMPS USED IN EXPERIMENTAL LIGHTING OF HARVARD FOOTBALL PRACTICE FIELD

been called into the problem by the officials of the Harvard Athletic Association, and under his direction a series of tests have been made within the past few days which will furnish the basis of a private report discussing the energy, intensity of illumination, and equipment requirements of the proposed service. Readings have been taken by the photometric staff of the Boston Edison company, and preliminary football practice at dusk with various types of reflectors and diffusing screens has been tried with success.

At a preliminary test eleven units were mounted on the east promenade at the top of the stadium, and the gridiron was illuminated by single reflectors and units in combination with the object of determining the apparatus best adapted to the peculiar problem in hand. The units in the main consisted of 500-watt or 1000-watt lamps, and included General Electric 500 and 1000-watt type L and type M equipment, the Western Electric "Davis" 1000-watt unit, a Knight & Games 1500-watt lamp mounted in a 32-in. reflector, two "X-Ray" reflectors with 250-watt lamps, Wheeler angle and straight reflectors, with lamps. The minimum reflector diameter shown was 10 in., and the maximum 32 in.

It appears from these tests, with lamps mounted 90 ft. above the field and about 300 ft. from the center of the gridiron, that the entire field can be fairly well lighted, except for punting, with an expenditure of about 20 kw.; that with an input of 30 to 35 kw. punting can be readily accomplished, and that with 40 kw. the entire gridiron can be given a relatively brilliant illumination suitable for every requirement in practice. In the tests energy was supplied by the Boston Edison company through a 110-volt metered circuit temporarily wired from a service outside the grounds of the stadium by Herbert S. Potter, electrical contractor, Boston.

The principal object of the installation contemplated is to enable students to carry on football practice without the interference with laboratory work and other instruction, which is at present subject to rather severe "cutting" on account of the limitations of daylight in the fall season, when both practice and match games are an absorbing feature of the life of the university. Data as to the foot-candle requirements for the proposed work are not yet available for publication. In view of the comparatively short time during which energy will be demanded for flood-lighting the field, it is probable that the initial cost of the equipment will be a more important element in the selection of apparatus than the energy consumption. It is possible that the installation when completed may be used at the end of some of the match games late in the fall, although the main problem before the Athletic Association is to extend the period of practice.

According to a rule of the college, no football game is allowed to start before 2.45 p. m. until Nov. 1, and the provision of a satisfactory installation will be greatly appreciated in an emergency.

Huge Electric-Lighted Clock on Moving Picture Theatre at Indianapolis

The new Circle Theater at Indianapolis is one of the most elaborate motion-picture theaters in the Middle West. A feature of its attractive exterior is the large electric clock shown, the dial of which measures 25 ft. in diameter. The clock mechanism is also electrically driven, being actuated by a Betts & Betts master-clock movement in the office of the theater.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

ELECTRIC WATER HEATERS FOR DOMESTIC SERVICE

A Description of Various Types of Electric Water Heaters and Their Value as Load Builders for Central Stations

ELECTRIC water heaters are attracting more and more the attention of central station managers, especially on the Pacific Coast. There is no doubt that electric hot-water apparatus represents a new attractive load and considerably strengthens the position of electric cooking and heating. From this standpoint the points of interest are the amount of energy consumed and the possibility of improving the load factor (by thermal storage). Success in both respects depends to a certain extent on the design of the water heater. The London *Electrician* of Sept. 8, 1916, contains an interesting article, based chiefly on European practice, by C. W. Crosbie, on this subject.

Of the many electric water heaters described the "Belenus electric boiler" (Fig. 1) takes the place of

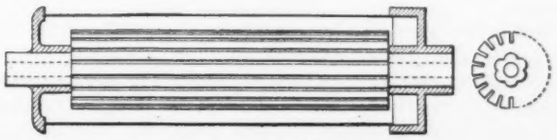


FIG. 1—BELENUS ELECTRIC BOILER

the ordinary saddle-back boiler fitted to kitchen ranges, and is installed in a like manner. It consists of a cast-iron cylinder having a longitudinally corrugated bore to furnish as large a heating surface in contact with the water as possible. The exterior is slotted for the reception of the heating elements. Each slot takes a 500-watt element, and there are eighteen such elements which may be connected in any desired combination. For heat control four or five switches are provided, making possible a variation from 0.5 kw. to 9 kw. This heater has the disadvantages of a heavy maximum demand and of much time required to bring large quantities of water to the requisite temperature, but when connected to the water system of the house and a storage tank, it would in every way meet the requirements of the domestic consumer.

"Geysers" are designed for a rapid production of hot water. The British electric geyser (Fig. 2) consists of a porcelain tube packed with carbon granules through which the water passes, and which also constitutes the heating element. The heater is provided with an interlocked switch and tap. The water in its passage through the carbon is claimed to be sterilized by electrochemical action and delivered pure at the nozzle. Hot or cold water may be drawn at will according to the position of the control handle and for any length of time, the cold water being filtered by the carbon granules. Geysers on this principle are built for a delivery of from 22 gal. to 40 gal. of water per hour with a rise in temperature of 60 deg. Fahr. to 100 deg. Fahr., the consumption being approximately 200 watts per gallon. For baths such heaters are connected hydraulically and electrically in parallel, the loading being 15 kw. The efficiency of the apparatus is about 98 per cent at the nozzle.

Of thermal-storage systems four are described. The Cooper water heater (Fig. 3) consists of a water tank within a water tank, the essential feature being that only a portion of the water contained is heated directly by the immersion element, the remainder being heated indirectly. The immersion heater is fitted to the inner or small tank by insertion from the top. The inner tank draws in water at the bottom through two tubes which project into the water jacket, and are carried up nearly to the top. The cold water supply is connected to the bottom of the water jacket, and the draw-off connection is at the top of the inner or heating chamber. The object of this construction is to obtain a small quantity of water rapidly raised to temperature and, further, to allow for additional heat storage in the surrounding water jacket when no demand is made on the apparatus. The heater is rated at 750 watts and is capable of heating, daily, 100 gal. of water from 60 deg. Fahr. to 110 deg. Fahr., and being left on circuit continuously has a load factor of 100 per cent and efficiency of 80 to 87 per cent.

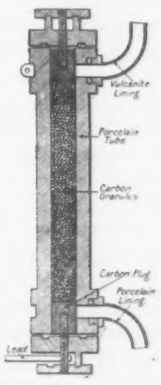


FIG. 2—BRITISH ELECTRIC GEYSER

The Ferranti water heater consists of a cylindrical storage tank similar to those used with kitchen ranges, a pipe connection being made at the bottom of the tank, carried up and reinserted at the top. This circulating pipe connection carries the heater, consisting of a cast-iron tube with heating elements clamped thereto. The whole apparatus is thoroughly lagged to prevent loss by radiation. The hot water is taken from the tank at the top. The rating is 350, 500 or 750 watts on continuous load, according to size and requirements of the household. The maximum demand is low, efficiency about 85 per cent and load factor 100 per cent.

The Therol water heater consists of a lagged tank in which, separated by a jacket, is a block of cast iron

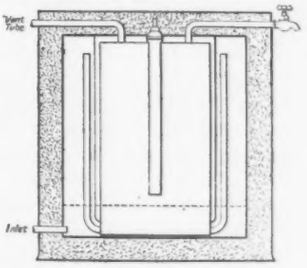


FIG. 3—COOPER WATER HEATER

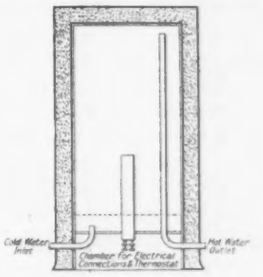


FIG. 4—LOSLES WATER HEATER

housing the heating elements. The iron block is pierced by a number of tubes which communicate with the water in the surrounding jacket. Upon first switching on the current the temperature of the whole mass of iron is gradually raised to about 500 deg. Fahr., and as soon as the water is admitted to the block from the surrounding jacket it is heated instantaneously and

vaporized. The temperature of the water is controlled by a three-way tap by the admixture of cold water with the steam, or boiling water, produced in the heating block. With a rating of 200 watts on continuous load from 20 gal. to 30 gal. of water can be produced per day at a temperature of 110 deg. Fahr. The maximum demand is low and the load factor 100 per cent.

The Losles water heater consists of a lagged cylindrical tank with an immersion heater introduced through the bottom of the tank (Fig. 4). A thermostat is fitted to the apparatus for the purpose of controlling the heater and maintaining the water at a prescribed temperature, and when this temperature is reached the heater is automatically switched off. The cold water supply and the hot water draw-off connections are made at the bottom of the tank, the latter rising through the mass of water and terminating very near the top of the tank with a view to reducing the losses to a minimum. The apparatus is rated at 1000 watts for a storage capacity of 10 gal. of water, and is capable of providing 84 gal. of water per twenty-four hours raised through 38 deg. Fahr., or 20 gal. per twenty-four hours through 150 deg. Fahr. The maximum demand is higher than that of a continuously-rated heater of the same thermal storage capacity, and the loading being intermittent the load factor is approximately 50 per cent and the efficiency from 87 per cent to 90 per cent.

The author then discusses the actual requirement of domestic service and gives load curves for different systems. The final conclusion is that the thermal storage system is the only one which can seriously be considered on a large scale; the maximum demand is so low as not to aggravate the difficulty of mains; further, the storage taking place on the consumer's premises furnishes an ideal system in respect to distribution, excelling even that of water and gas supply, and the best possible load factor, *i.e.*, 100 per cent, should enable electric undertakings to offer current at 0.5 cent per unit for this purpose with excellent financial results to themselves.

Generators, Motors and Transformers

Pliotron Oscillator.—WILLIAM C. WHITE.—Hot cathode tubes have been in practical use a number of years for the reception of the extremely small currents in radio telegraphy and telephony. However, the electrical properties of such tubes find applications in other fields, when, as in the case of the pliotron, they are capable of handling larger amounts of energy and at higher voltages. In the present article the use of the pliotron for the production of alternating currents is described. The pliotron (Fig. 5) has three elements, filament, grid, and plate, all inclosed in an evacuated globe. The tungsten filament is about 10 in. long and W-shaped, the four spans lying in the same plane. The grid surrounds the filament, and consists of a mesh of very small tungsten wires lying in two planes, one on each side of, and parallel to, the plane of the filament. This is made by winding the tungsten wire for the grid on a rectangular frame. The planes of the grid wires are each about ⅛ in. distant from the plane of the filament. The plate consists of two rectangular sheets of thin tungsten about 1.75 in. by 2.5 in., and these sheets are spaced parallel to each other about 0.5 in. apart; these are held in the bulb so as to be parallel to the planes of the grid and filament and, therefore, each one is spaced about 0.25 in. from the filament. These pliotron tubes are evacuated to a high degree and the metal of the grid and the plate is freed from gas. In operation the filament is made incandescent as in a lamp, and if then a positive potential, with respect to the filament, is applied to the anode a current will flow between the two, due to the passage of electrons from the filament to the plate. Providing the filament is emitting sufficient electrons, the number of electrons reaching the plate per unit of time (and thus the current between filament and plate) depends upon the potential gradient, and, therefore, this current increases with the plate voltage. Now the electrons in their passage must pass through the mesh of the grid. Any change in potential of the grid with respect to the filament changes the electric force distribution, the electron current. If the grid is made positive with respect to the filament the electrons are accelerated and the current increases; if negative, their acceleration is retarded and the current decreases. Suppose an arrangement as shown in Fig. 6, where *F* represents the fila-

Fig. 5

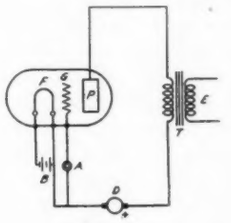


Fig. 6

FIG. 5—PLIOTRON TUBE COMPLETE; FIG. 6—DIAGRAM OF CONNECTIONS TO ILLUSTRATE THE PRINCIPLE OF THE PLIOTRON OSCILLATOR

ment, *G* the grid, *P* the plate of a pliotron and *D* is the source of direct current in the plate circuit. A transformer, one coil of which is in the plate circuit, is represented by *T*, and *A* is an alternator supplying an alternating potential to the grid *G*. During one-half of the cycle of the alternator potential the grid is positive with respect to the filament, and during the other half it is negative. Since the plate current is controlled by the grid potential the former will also vary, following the sine wave of the alternator, periodically varying between a minimum and a maximum, but never reversing in direction. However, from *E*, the secondary of the transformer, a real alternating current may be obtained. The energy of this alternating current obtained at *E* is drawn from the direct-current source *D*, and is of exactly the same character as that supplied by the alternator *A*, but of much greater energy, because very little energy is required to vary the potential of the grid *G*. Suppose 1 watt is supplied to *A* and 10 watts of the same character alternating current is obtained at *E*, it should then be possible to utilize 1 watt of the 10 then obtained at *E* to supply the grid, in place of using the alternator, and thus make the system self-exciting. Such an arrangement as just described constitutes a pliotron oscillator system. For the correct operation of the pliotron as an oscillator it is very important that the potential returned to the grid for excitation has the correct amplitude and phase relation with respect to the plate current. The frequency of the alternating current which a self-exciting system of this type generates will, of course, depend on the electrical constants of the circuits. Various connections have been devised for this purpose. In practice, either one of two general methods is employed, or a combination of the two; that is, sufficient energy is supplied the grid to keep the system oscillating either by electromagnetic or electrostatic coupling. The author first takes up the production of currents of very low frequencies (0.5 cycle per second); in this case it is advisable to provide for both electromagnetic and

electrostatic coupling between the grid and plate circuits. He then discusses the production of very high frequencies (50,000,000 cycles per second). In this case it is necessary to reduce the inductance and capacity of the circuits to a minimum; in fact, the natural capacity between the elements inside the pliotron bulb is more than sufficient to supply electrostatic coupling between the plate and grid circuits. The electrical connections employed for both cases are illustrated in diagrams that accompany the article.—*Gen. Elec. Review*, September, 1916.

Lamps and Lighting

Radiant Luminous Efficiency of the Carbon Incandescent Lamp and the Mechanical Equivalent of Light.—HERBERT E. IVES and E. F. KINGSBURY.—According to the recent researches of the authors on the mechanical equivalent of light one lumen is equivalent to 0.00159 watt of luminous flux. On the other hand, Pirani and Miething, Meyer, and Langmuir using in part data of Lummer and Pringsheim and Nernst on black-body brightness have arrived at figures 20 to 30 per cent lower. The present authors believe that the latter method is questionable in the present state of our knowledge of the black-body constant. They now have made a check on the order of magnitude of the constant by a method which consists in brief in determining the radiant luminous efficiency of a chosen light source, and comparing this with the total luminous efficiency, thereby obtaining the efficiency losses due to conduction, convection, etc. These are then compared with the estimate of these losses as obtained by independent means. They use a carbon incandescent lamp whose efficiency losses are approximately known. They estimate that the wire losses, the convection losses and some additional losses are about 9 per cent, so that 91 per cent is the radiation efficiency. This value agrees well with the value of radiation efficiency, 91.5 per cent, which they find on the basis of their own value for the mechanical equivalent of light. If, on the other hand, they use the value of the mechanical equivalent arrived at by Pirani, 0.00123, the radiation efficiency works out at 71 per cent, "which is almost out of the question." The authors conclude that the value 0.00159 is substantially correct for the mechanical equivalent of light, where light is defined by the luminosity curve, and measured by the photometric method (in agreement with that curve) used by them.—*Phys. Rev.*, Sept., 1916.

Electrophysics and Magnetism

Rectifying Contact of Two Solid Conductors.—D. OWEN.—An illustrated London Physical Society paper on the laws of variation of resistance with voltage at a rectifying contact of two solid conductors, with applications to the electric wave detector. A series of contacts was examined in a number of cases of different metals, the results being to show (1) that the voltage coefficient at zero voltage is independent of the resistance; (2) that the sign of the coefficient is negative; (3) that a minimum occurs on the side of positive voltage. It is concluded that the phenomena occurring at metallic contacts are thermo-electric in nature, and are essentially identical with those of mineral contacts. The law of constancy of the voltage coefficient can be applied to the receiving circuit in which a contact detector is employed in series with a magnetic telephone. The requirements for high sensibility are first discussed for the case that no polarizing voltage is used. For high sensibility the contact should be of materials having as large a voltage coefficient as possible; the resistance of the contact should be low (the lowest value depending on the impedance in receiving antennae, etc.); the resistance of the telephone should be about one-third that of the contact. The author finally discusses use of a direct-current galvanometer in series with a rectifying contact in null alternating-current bridge methods. If the galvanometer be regarded as given, then for highest sensibility the resistance of the contact should be equal to that of the galvanometer, but if a given contact be taken then the best galvanometer to choose is one of resistance one-third that of the contact at zero voltage.—*Proceedings Phys. Soc'y* of London, June 15, 1916; a long illustrated abstract on this subject wa spublished in London *Electrician*, Sept. 22, 1916.

Telegraphy, Telephony and Signals

Characteristic Curves of the Poulsen-Arc Generator.—N. W. MCLACHLAN.—A paper read before the British Association at the Newcastle meeting. It has been shown by Mercer that with a carbon-copper arc burning in an atmosphere of hydrogen, without a magnetic blast, having a condenser (the capacity not exceeding a certain limit) and a variable inductance shunted across its terminals, there is a certain inductance, and, therefore, frequency, for which the shunt current is a maximum. The present investigation was undertaken to determine whether this condition is applicable in the case of a Poulsen-arc generator: (1) when energy is absorbed in the shunt circuit by a variable non-inductive resistance; (2) when the energy absorbed in the shunt circuit is as small as possible. In both these cases there is a loss in the Moscicki condensers, this being unavoidable, unless air condensers are used.—London *Electrician*, Sept. 15 and 22, 1916.

Miscellaneous

Review of Electrical Developments.—On the occasion of the publication of its 2000th issue the London *Electrician* gives a series of reviews of electrical developments in the last forty years. W. R. Cooper discussed milestones on the path of progress, R. E. Crompton early developments of electrical engineering, H. H. Harrison land telegraphy, Charles Bright the submarine cable, E. Raymond-Barker the speed of submarine telegraphy, J. E. Kingsbury the story of the telephone, B. S. Cohen long-distance telephony, Miles Walker dynamo-electric machinery, C. C. Paterson the evolution of the electric lamp, H. F. Parshall electric traction, C. J. Beaver electric light and power cables, Frank Crawter storage batteries, J. A. Fleming wireless telegraphy, J. Swinburne technical research, P. V. Hunter development of electric power stations, D. Wilson boiler development, H. H. Broughton electrically driven coal-handling plant, A. P. Trotter improvements in the sensitiveness of apparatus at the British Board of Trade electrical standards laboratory, C. V. Drysdale measuring instruments, G. W. C. Kaye Roentgen rays, F. M. Perkin electrochemistry, etc.—London *Electrician*, Sept. 15, 1916.

Limit Gages.—R. T. GLAZEBROOK.—An abstract of a paper read before Section G of the British Association. After discussing the fundamental idea of limit gaging—that the dimensions of a piece of work should lie between certain definite values, and that the engineer should possess some means of measurement which would enable him readily to tell if this was the case—the author discusses in this paper the use, permissible limits of accuracy and the methods of measuring or otherwise determining the dimensions of the various classes of gages. These are subdivided into three groups: (1) Gages for plain cylindrical work; (2) screw gages; (3) form and position gages. Each group is separately discussed.—London *Electrician*, Sept. 22, 1916.

R. A. LUNDQUIST

Men of the Industry

Changes in Personnel and Position—Biographical Notes

R. A. Lundquist, who has been selected by the bureau of foreign and domestic commerce, United States Department of Commerce, to study the markets for electrical goods in China, India, Australia, South Africa, and a number of other countries in the Far East, has for the last five years been a consulting engineer in Minneapolis, Minn. He was graduated from the University of Minnesota in 1905, with the degree of electrical engineer, and afterward put in six years with well-known electrical firms. Since 1911 Mr. Lundquist has been in consulting practice in Minneapolis, specializing in hydroelectric and transmission-line work. He is the author of "Transmission Line Construction—Methods and Costs," and has contributed numerous articles to the technical press. Mr. Lundquist is chairman of the Minnesota Section of the American Institute of Electrical Engineers.

Alfred E. Hanson has been appointed a member of the staff of the National Bureau of Standards, Washington, D. C.

E. B. Mallory has resigned as Eastern sales manager of the Economy Fuse & Manufacturing Company of Chicago. Mr. Mallory was at one time president of the company, but retired from executive work several years ago to devote his time to Eastern sales, with headquarters at New York City.

H. C. Hoagland, who has been general manager of the Fort Smith (Ark.) Light & Traction Company, has been transferred to Muskogee, Okla., and will have charge of the plants of H. M. Byllesby & Company in Muskogee, Oklahoma City and El Reno. Mr. Hoagland will maintain his headquarters in Muskogee.

J. F. Wilson, for the past five years a member of the engineering faculty of the University of Michigan, has been appointed professor of electrical engineering at Queen's University, Kingston, Ont., and entered on the duties of that position Oct. 1. Mr. Wilson is the author of a widely used dynamo laboratory manual, and recently published an elementary text-book in electrical engineering.

V. S. McPenny was re-elected president of the Washington Association of Electrical Contractors & Dealers at the annual convention held at the Butler Hotel, Seattle, Wash., on Sept. 19 and 20.

George J. Newton, for the last ten years designing engineer with G. M. Gest, New York City, has been engaged by W. S. Barstow & Company, 50 Pine Street, New York City, to design and supervise the construction of the underground distribution system for the Pennsylvania Utilities Company in Easton, Pa.

W. H. Blood, Jr., gave an address on the subject of the Stone & Webster organization before the senior class of the Massachusetts Institute of Technology, Cambridge, Oct. 5. Early in 1917 Mr. Blood will deliver a course of lectures on public utility operation before the Harvard Graduate School of Business Administration.

Axel J. Stahl, formerly with the General Electric Company at Schenectady, N. Y., for several years engineer with the British Thomson-Houston Company, and chief electrical engineer of Graham Brothers in Stockholm, Sweden, has organized an engineering firm with headquarters in Stockholm to carry on a business of general engineering.

Lucien Barnes has resigned as the export manager of the Westinghouse Lamp Company, New York City, with which he has been connected for the last ten years, to take the position of purchasing agent with R. Martens & Company, 24 State Street, New York City. This company does a large machinery export business to Continental Europe, with Russia as its chief field of activity. Last winter, for the Westinghouse Company, Mr. Barnes made a trip of approximately 30,000 miles through South America, Central America, and the West Indies.

Andrew N. Fox has resigned as advertising manager of the Benjamin Electric Manufacturing Company, Chicago, to become president of the R. & F. Copper Mining Company of Nevada, which will work an extensive property at Clarkdale, Nev., which has been owned by Mr. Fox and a partner for some years. Mr. Fox has been very active in organization work among electrical men and advertising men in Chicago and was awarded the Big Brother Cup at Philadelphia last June in appreciation of work in organizing the greatest number of local advertising clubs. He is also a past-president of the Chicago Executive Club. Mr. Fox's new headquarters are located at 1911 Harris Trust Building, Chicago, Ill.

W. B. VOTH

William B. Voth of Syracuse, N. Y., has been appointed manager of the Ogdensburg (N. Y.) Gas, Power & Light Company, succeeding E. Eugene Hawkins who has been at the head of the company for the past twelve years. Mr. Voth is a graduate of the University of Wisconsin, taking a degree in electrical engineering. Two years ago he accepted a position with the Empire United Railways of Syracuse. Later he went with the Auburn & Syracuse Electric Railroad Company and subsequently with the Syracuse & South Bay Electric Railroad Company, acting as the company's chief engineer and purchasing agent.

R. P. Winton, who has been instructor in electrical engineering in the Sheffield Scientific School of Yale University, New Haven, Conn., has resigned to accept a position in the construction department of the Philadelphia Electric Company.

Jiro Komiya, electrical engineer to the Imperial Japanese Government Railways, has been commissioned to spend a year in the United States to study modern practice in this country in the transmission and distribution of electrical energy. Mr. Komiya is now in the northwest inspecting the power company systems and the electrified branches of the Southern Pacific Railroad south of Portland.

Obituary

Allen A. Brown, president of the Boston Electric Associates, died at his home in Boston, Oct. 2. He was born at Boston in 1835, and had been associated with the gas and electric properties in Massachusetts south and east of the Cape Cod Canal and including Martha's Vineyard, since 1896. Mr. Brown was the donor of the Brown Music Library to the Boston Public Library, containing many priceless manuscripts. There will be no change in the management of the utilities concerned as his brother, Arthur K. Brown, of Boston, who has been vice-president of the Boston Electric Associates for the past six years, is expected to succeed him.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

An Electric Porcelain Percolator

A rather unique line of electrical percolators with a heating element embedded in the porcelain is being manufactured and marketed by the Rochester Stamping Company of Rochester, N. Y. The manufacturer points out that porcelain cracking due to high temperature is practically impossible because the expansion rate of the porcelain is the same as that of the metal surrounding it. It is also claimed that the metallic taste which coffee often has when made in the ordinary percolator is absent when the porcelain set is used. These percolators are furnished in two sizes and artistic shapes. The percolator illustrated is part of a set consisting of percolator, six fancy cups and a serving tray.

ARTISTIC PORCELAIN PERCOLATOR SET

Insulating Paint

"Ohmlac" and "Hy-Black" are two trade names for an insulating paint made from a mineral hydrocarbon, which in outward aspect resembles India rubber. The raw product is called "Elaterite" and is mined in Utah, and is not solvent in acid or alkali. In making the paint this material is used as a base and being combined with non-oxidizing oils is held in solution in naphtha. Besides possessing insulation qualities, it is claimed that this paint affords protection against the elements, against gases, sulphur, electrolysis acids, alkalis and water.

Tests made on wire coated with this material show that it will withstand temperatures up to 400 deg. Fahr. for at least three hours without damage. In another test a sample 0.047 in. thick was tested by placing it between metal plates to which increasing voltages were gradually applied, as follows:

Sample "A" 0.047 in. Thick.—4100 volts for five minutes; 6000 volts for five minutes; 7500 volts for five minutes; 8400 volts for two minutes; 10,000 volts for five minutes; 13,000 volts for seven minutes. After holding 13,000 volts for seven minutes the sample punctured.

These paints are made by the Union Insulating Company, 20 West Jackson Boulevard, Chicago, and are suitable for coating field coils, armatures, poles, wires, cables, transformers and batteries.

Feed-Through Flatiron Switch

The Hart Manufacturing Company of Hartford, Conn., has started to manufacture a line of feed-through switches differing essentially in principle from the regular "Diamond H" line. One form of this switch, used in connection with the "Universal" flatiron is illustrated herewith. The switch parts are contained between two sections of moulded insulation held together by a strap which also serves to hold it to the iron in question. A spring and pin inclosed within the push button operate the cam of a pivoted switch lever on the end of which is the current-carrying contact which bridges the circuit or ruptures it according to which side is pushed. The action is easy and the make and break contact is effected with a snap. A removable flexible spring re-enforcement is provided for the conductors used in placing the iron in circuit and usual spring clips make contact with the current-carrying prongs of the flat-iron. A sectional view of the switch shows its makeup and action. It is the expectation of the Hart Manufacturing Company to place on the market, shortly, a pendant switch operating on the same principle, together with a line of feed-through switches.

FIG. 1—ASSEMBLED FEED-THROUGH SWITCH

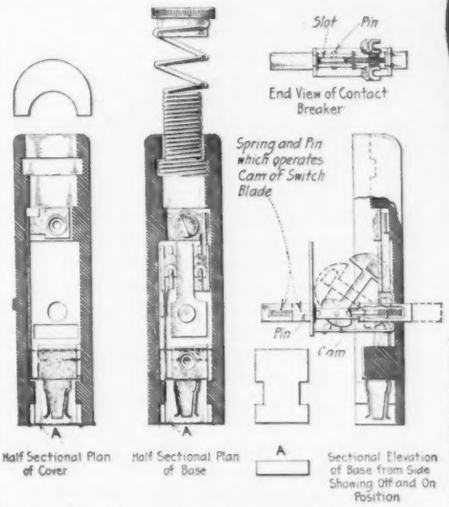


FIG. 2—CONSTRUCTION OF FEED-THROUGH SNAP SWITCH

Overload and Reverse Phase Relays

The General Electric Company has just started the manufacture of an induction type, time-limit, overload relay, which has been developed for use on those systems where extreme accuracy in timing is required for tripping two or more air or oil circuit breakers selectively. The operating or characteristic curves for the various time-current settings, it is pointed out, are entirely separate and distinct at even the heaviest overloads and never become instantaneous. This is because of the inherent characteristics of the relay which produce a curve consisting of an inverse time portion up to approximately 2000 per cent of minimum contact closing

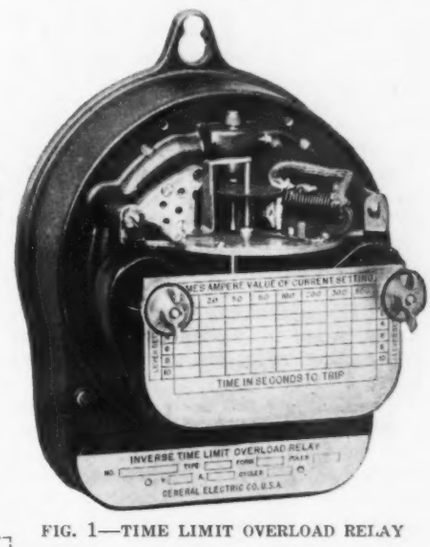

MULTIPLE AMPERE VALUE OF CURRENT SETTING
TIME IN SECONDS TO TRIP
INVERSE TIME LIMIT OVERLOAD RELAY
GENERAL ELECTRIC CO. U.S.A.

FIG. 1—TIME LIMIT OVERLOAD RELAY

current, blended into a definite time portion with a slight downward slope. Consequently, the relay will do the work ordinarily required of both inverse and definite time limit relays. The heaviest overloads do not disturb the form of the curve, it is claimed, nor cause vibration or chattering of the moving parts.

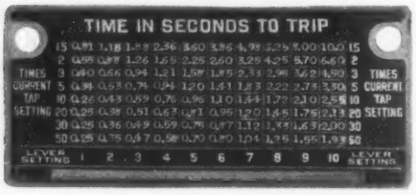


FIG. 2—INDEX PLATE GIVING TIME DELAY FIGURES

This relay is made in single pole elements, is circuit closing, and operates with a time delay which is inverse for the lower current values and which approaches a definite minimum for the higher current values. It is designed for use in the secondary of current transformers, the normal load rating being 5 amp. However, by means of the current tap plate, the relay may be set for 4, 5, 6, 8 and 10 amp., positive operation being obtained throughout this range. The contacts are closed on overload by the rotation of a disk actuated by a "U"-shaped driving magnet with shading coils on the pole pieces. No tripping current is carried through the revolving parts. When the contacts have been closed they are firmly held in that position until tripping occurs, by the armature of a holding coil connected in series with the contacts, the trip coil of the air or oil break circuit breaker and an auxiliary switch which opens when the breaker is tripped. This insures current on the trip coil continuously until the circuit breaker opens, and prevents flashing at the relay contacts. The values given in vertical columns 1 to 10 on the index plate are the time delays which will be obtained at the different degrees of overload represented in the "Times Current Tap Setting" columns at the extreme right and left sides of the index plate. The factors appearing in the "Times Current Tap Setting" columns, when multiplied by the current tap setting, represent actual secondary current values.

The contacts are designed for use on direct current. They are made of a special metal which is non-corrosive and which has high heat resistance. They will carry 18 amp. momentarily without damage to the contact surfaces. The current closing capacity is therefore ample to trip even the largest of the General Electric Company's circuit breakers. A thermostatic device within the relay compensates for any variations in room temperature. Following wattmeter construction, the movable element is supported by a jewel bearing, thus minimizing friction and eliminating vibration. A dustproof glass cover protects the operating parts of the relay and facilitates the reading of the index plate.

The relay is being made in two styles, one for 25 and one for 60-cycle circuits. Although the principle of operation and the inherent characteristics are the same in both relays, the relays themselves differ only in slight details of construction.

Another new General Electric relay design is the reverse phase relay shown in Fig. 3, made in both circuit-opening and circuit-closing styles. The type of contacts required for any installation depends on the method of tripping out the motor switch. When contactors alone are used, circuit-opening contacts are recommended. The circuit-opening contacts are hand reset. Circuit-closing relays are used in connection with a shunt trip on air or oil circuit breakers. Contacts of either type are of strong toggle construction and are protected by a dustproof cover.

The relay operates on the same principle as a squirrel-cage induction motor. The operating coils correspond to the stator and a hollow aluminum cylinder, connected to the contacts, corresponds to the rotor. The cylinder (plunger) does not rotate, but moves in a straight line, either up or down, depending upon

FIG. 3—REVERSE PHASE RELAY WITH COVER REMOVED

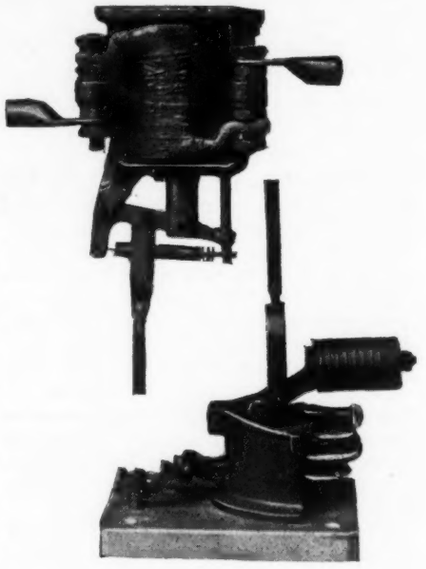
the phase rotation. When one of the phases of the line is reversed the plunger moves and operates the circuit-opening or circuit-closing contacts.

These relays are made for two-phase or three-phase service with either current or potential windings, depending upon the amount of current and the voltage of the circuit. Current windings, which will cause the relays to operate on phase reversal at 70 per cent of normal current, are supplied for the following conditions: (1) For circuits up to and including 100 amp. and 550 volts, connected in series with the line. (2) For circuits above 100 amp. up to and including 550 volts, connected in the secondaries of current transformers. (3) For circuits of 600 volts and above at all currents, connected in the secondaries of current transformers. Potential windings are supplied for circuits up to and including 550 volts, connected directly across the line and for circuits above 550 volts connected to the secondaries of potential transformers. These coils are furnished with external resistances of the proper value for the different voltages.

Overload Relay for High Voltage Circuits

For high-voltage stations, where the extra cost of current transformers prohibits the use of extremely accurate relays for overload protection, the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has produced an overload relay which, it is claimed, is an economical substitute, affording ample overload protection and a fairly accurate time element. This relay is known as the type HB, and consists of a strongly built solenoid mechanism which operates a timing and circuit closing element through a micarta chain of such length as to provide ample insulation for the voltage in use. There is no lost motion in the chain, it is pointed out, since it is constantly in tension; the action of the solenoid raising a weight on the contact mechanism. For voltages up to 44,000 the chain consists of twelve links. Twenty links are provided for voltages up to 66,000, and thirty links up to 110,000 volts. The links may be removed to shorten the chain down to a minimum of one link for each 6,600 volts. While the relay coil is made for inserting directly in the high voltage line, the contacts and timing parts are thoroughly insulated and can thus be handled, adjusted, or tested without disconnecting the feeder. The coil can be mounted on a disconnecting switch or choke coil and the use of separate insulators avoided, while the contact mechanism can be mounted in the position most convenient.

This relay is furnished in two forms —one having an inverse time element, the other a definite time element. The inverse time element relay can be set



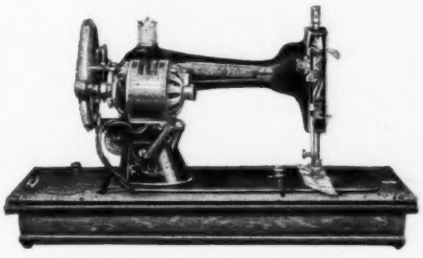
RELAY SOLENOID MECHANISM—AT TOP; BELLOWS AND VALVE OF OVERLOAD RELAY—AT BOTTOM

practically instantaneous. In this form of relay the solenoid and chain are opposed in their motion by a bellows with an adjustable valve. The valve has a small numbered dial which permits of any setting between a maximum time element of about 20 sec. at 25 per cent

overload and a minimum of about 1 sec. at the same overload. With greater overload the relay acts in a shorter time. In the definite time element relay the same kind of bellows and valve are used as for the inverse time limit, but the solenoid chain does not act directly on it. The core and chain rise instantly when current reaches the tripping valve, and compress a spring. The spring in turn acts on the bellows. If the overload continues during the time for which the relay is set the tripping contacts close. The time required for the spring to close the contacts depends only on the setting of the valve, and is entirely independent of the magnitude of the overload. The relay can be set for any time element between 1 and 10 sec. The minimum current at which the relay will trip depends on the number of weights placed on the arm of the contact-making mechanism. This can be varied from 80 per cent to 160 per cent of the rated current of the relay. One relay is required to protect a single-phase circuit, two relays for a two-phase or three-phase ungrounded neutral circuit, and three relays for a three-phase grounded neutral circuit.

Portable Electric Sewing Machine

The Western Electric Company, Inc., is offering the trade this fall a portable electric sewing machine, which can easily be carried from room to room. The



PORTABLE ELECTRIC SEWING MACHINE WITH COVER REMOVED

entire equipment—the sewing machine head and the motor—is completely inclosed in a quarter sawed oak cover which occupies only a small amount of space, and when not in use may be placed out of the way in a closet or under a couch.

The important features of this machine are its portability and its operation from an ordinary lamp socket on either direct or alternating current.

Projector for Flood-Lighting Large Areas

A projector is shown herewith, which is said to produce a non-blinding yet a penetrating light, and is well adapted to flood-lighting where the effect of the light on the workman's eyes is to be considered. The lamp is manufactured by the Electric Service Supplies Company, Seventeenth and Cambria Streets, Philadelphia, Pa. The reflector is molded from a green-ish-yellow glass, ground to a true parabola, which is polished and silvered to a high finish. Violet, ultra-violet and other high-frequency rays are absorbed by the glass reflector, whereas the golden-yellow light, which, it is claimed, is non-blinding and adapt-

FLOOD-LIGHTING PROJECTOR WITH 12-IN. REFLECTOR

ed to the penetration of fog, dust or moisture, is projected in the beam.

Two sizes of the projectors are being manufactured, the smaller being equipped with a 9-in. diameter reflector while the larger size employs a 12-in. reflector. Concentrated filament lamps of any wattage up to 150 in G-25 bulbs having a light-center distance of 2.25 in. may be used with the 9-in. reflector, while the 12-in. reflector takes concentrated-filament lamps up to 250 watts in G-30 bulbs having a light center distance of 2.75 in. A focusing device is accessible from the outside of the shell so that the light may be projected in a straight beam or dispersed.

A Portable Garage Lamp

A garage lamp, known as the "Alvo-Lite," which is designed to set on the floor and throw light up at various an-

LAMP FOR WORKING BENEATH AUTOMOBILES

gles under an automobile, is shown in the accompanying illustration. This lamp is made by The A-A Electric Manufacturing Company of Bridgeport, Conn., and consists essentially of a strong spun-steel reflector, equipped with a socket and an adjustable spring-standard. A plug and 15 ft. of cord is attached. The manufacturer calls attention to the fact that the socket itself provides an easy handle when the lamp is used for trouble hunting. Any size lamp will fit but the 60-watt Mazda is best adapted.

Flexible Tubing Fastener

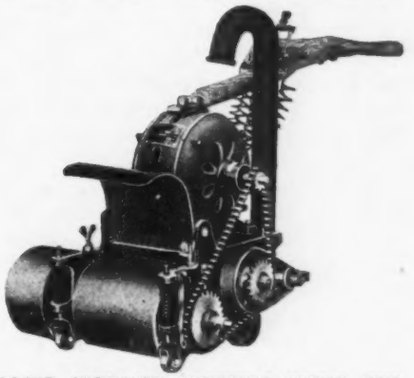
A fastener for securing ¼-in. and smaller flexible tubing to switch and outlet boxes is now offered the trade by the McKee Wire Fastener Company, 431 St. Clair Street, Toledo, Ohio. The fastener consists of a piece of copper-plated steel wire No. 15 B W G, bent into the shape shown herewith approximately in full size. The ends of the wire are bent inwardly and at an angle with the plane of the fastener, with sharp ends designed to engage the surface of the flexible tubing over which

SHAPE OF FASTENER FOR FLEXIBLE TUBING

the device is placed. It is claimed that the prongs will not penetrate the tubing sufficiently to injure the lining. When the fastener is placed over the piece of tubing extending through an opening into a switch or outlet box, and the tubing then pulled back until the fastener lies against the inner surface of the box, the inwardly projecting prongs will engage the surface of the tubing and hold the latter in place. The device will hold both the ¼-in. and smaller sizes of flexible tubing.

Floor Surfacer

The small floor surfacer shown in the accompanying illustration is manufactured by M. L. Schlueter, 225-227 West Illinois Street, Chicago, Ill., and is particularly adapted for work required in residences, office and apartment buildings. The machine consists of a steel frame, with ball-bearing rockers, supported on a pair of truck-wheels, and equipped with a 12-in. by 8½-in. roller, and a 4½-in. edge roller. The roller is mounted in front and around it is fastened sandpaper or other abrasive material. The motor which drives the roller at 700 r.p.m. is mounted on the frame and also operates an exhaust fan mounted under the frame to suck up the cuttings from the floor. By lifting the



FLOOR SURFACER SHOWING MOTOR CONNECTION TO ROLLER AND FAN

handle the machine moves forward, and releasing it the roller lifts itself from the floor to prevent grinding in one spot.

NEWS OF THE INDUSTRY

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

Associated Manufacturers of Electrical Supplies Activities

The board of governors of the Associated Manufacturers of Electrical Supplies held its first meeting since the summer on Sept. 27 at the office of the association in New York City. There was a full attendance, and many lines of activities for the different sections were discussed and approved for the coming winter, which promises to be a busy one. There are now fourteen sections organized and in active operation, and the association has practically doubled its membership in the past year.

On the following day, at the Hotel Biltmore, New York, the manufacturers of carbon products held a meeting, at which time a section to be known as the carbon section was organized. J. F. Kerlin of the National Carbon Company, Cleveland, Ohio, was the temporary chairman of the meeting. G. P. Fryling of the Speer Carbon Company, St. Mary's, Pa., was elected permanent secretary and H. C. Stackpole of the Stackpole Carbon Company, St. Mary's, Pa., was elected treasurer. Nominations for permanent chairman were submitted to the board of governors, and Mr. Kerlin was appointed to this position. Rules governing the section were adopted, and the following standing committees named: Motor and generator brushes; carbon electrodes and specialties; lighting carbons. The meeting was adjourned until a special meeting called for Oct. 5 at the Electric League Club in Cleveland. Membership in this section is confined to members of the association engaged in the manufacture of carbon products. The molded or formed insulation section held its regular quarterly meeting at the Hotel Biltmore on Oct. 2, E. B. Hatch of the Johns-Pratt Company, chairman presiding and the following standing committees were appointed: Committee on standards—R. W. Seabury, chairman, Boonton Rubber Manufacturing Company; J. G. Miles, Westinghouse Electric & Manufacturing Company; S. H. Blake, General Electric Company; McConnell Shank, B. F. Goodrich Rubber Company; R. C. Buell, Johns-Pratt Company; F. E. Layman, Cutler-Hammer Manufacturing Company. Committee on membership—B. H. Howell, chairman, Hemming Manufacturing Company; Victor Steinberger, General Insulate Company; R. W. Seabury, Boonton Rubber Manufacturing Company. Traffic committee—H. M. Shaw, chairman, Shaw Insulator Company; Joseph Steinberger, General Insulate Company; S. C. Schenck, Belden Manufacturing Company. Committee on commercial development—Louis Steinberger, chairman, Electrose Manufacturing Company; H. T. Meyer, Duranoid Manufacturing Company; S. H. Blake, General Electric Company.

The wire and cable section will hold a dinner meeting on the evening of Oct. 18, at the Yale Club. This is the regular quarterly meeting of the section.

Invitations have been issued by the general secretary of the association to all manufacturers of magnet wire to attend a conference at the Hotel Biltmore, New York, on Oct. 19, at 10 o'clock. The purpose of this meeting is to determine whether the manufacturers of magnet wire prefer to organize as an independent section to be known as the magnet wire section, or as a magnet wire committee of the present wire and cable section. The counsel of the association, T. M. Debevoise, will be present, and will explain the activities from which other sections of the association have already derived much benefit.

Census of Electrical Manufacturers

A preliminary statement on the manufacture of electrical machinery apparatus and supplies showing a comparative summary for 1909 and 1914 on a number of establishments, those engaged in the manufacture, primary horsepower, capital, services, materials, and value of products has been issued by the Bureau of the Census, Department of Commerce. A summary of the electrical manufacturers showing the value of all electrical products manufactured in 1914 compared with that manufactured in 1909 will be found on page 264 of the ELECTRICAL WORLD for Aug. 5.

CENSUS OF ELECTRICAL MANUFACTURERS, 1914

	Census		Per Cent of Increase[1] 1909-1914
	1914	1909	
Number of establishments[2]	1,030	1,009	2.1
Persons engaged in manufacture	144,712	105,600	37.0
Proprietors and firm members	368	439	−16.2
Salaried employees	26,266	17,905	46.7
Wage earners (average number)	118,078	87,256	35.3
Primary horsepower	227,731	158,768	43.4
Capital	$355,725,000	$267,844,000	32.8
Services	109,097,000	69,574,000	56.8
Salaries	35,291,000	20,193,000	74.8
Wages	73,806,000	49,381,000	49.5
Materials	154,728,000	108,566,000	42.5
Value of products	335,170,000	221,309,000	51.4
Value added by manufacture (value of products less cost of materials)	180,442,000	112,743,000	60.0

[1] A minus sign (−) denotes a decrease.

[2] In addition, in 1914, ninety-one establishments, primarily engaged in other lines of manufacture, produced electrical machinery, apparatus and supplies tr the value of $24,261,961, and in 1909, 142 estal lishments of this charactes manufactured $18,728,916 worth of electrical machinery, apparatus, and supplieo as a subsidiary product.

Data on Lighting Utility Service in Colorado

Some studies recently completed in Colorado and made public by F. J. Rankin, electrical engineer for the Colorado Public Utilities Commission, indicate that electric service is being furnished to 175 cities and towns in that state and that the population now being served within the corporate limits of cities is 560,000. Making a reasonable allowance for the population served outside of cities and towns, electric service may be shown to be within the reach of approximately 600,000 people out of a total population for the state of approximately 900,000. In other words, in a new and undeveloped country, much of it mountainous and sparsely settled, a service efficiency of 67 per cent has been attained.

Continuing the analysis shows that electric service is furnished to 115 communities having a population of less than a thousand each. Of these 115 communities thirty-three are served by local plants; the remainder

are served from transmission systems. The transmission systems have so completely covered the State that electric service is available in eighty-two communities having a population of less than a thousand each, to say nothing of rural communities served. "It is reasonable to believe," said Mr. Rankin, "that practically none of these communities would have had service to-day except for the development of our transmission systems. The commission is fully alive to the fact that these 115 small communities cannot be given; at any rate they can afford to pay the same grade of service, no matter by what standard it be measured, as can be given in a city of 20,000 or 30,000 population. On the other hand, the commission does not feel that these small communities will demand the same grade of service as is demanded by the larger cities and towns. For these reasons an effort has been made to provide ample allowance in all proposed rules and regulations to take care of this situation."

Some other deductions made from the study show that 163 communities of the 175 are served from private plants and twelve from municipal plants. Of these 175 communities 120 are served entirely from transmission systems and fifty-five from local plants located in or near the city or town. It was also found that 97 per cent of the entire population is served by private plants and 3 per cent by municipal plants, while 76 per cent of the population is served from local plants and only 24 per cent from transmission systems. Of the communities served 93 per cent are served by privately owned utilities, 7 per cent by municipally owned utilities, 31 per cent by local plants and 69 per cent by transmission systems.

Public Service Commission News

California Commission

The Railroad Commission has issued an order denying the Sierra Electric Power Company a certificate of public convenience and necessity for the distribution and sale of electricity in certain parts of Butte, Colusa, Glen, Shasta and Tehama counties because this territory is now well served at reasonable rates by existing utilities. This rule of the commission is according to the principles laid down by it in previous cases, that a wise public policy demands that utilities doing their full duty to the public shall be treated with fairness and justice, and be protected in their spheres of operation against competition which does not better the condition of the public and which is economically unsound. The Sierra company was opposed by the Northern California Power Company, Consolidated, and the Pacific Gas & Electric Company.

"Petitioner is asking to enter a territory which is already being served by another utility of like character giving good service at rates prescribed by this commission," says the opinion of the commission. "There is nothing to show that petitioner could give as good service at rates any lower than those being charged by the existing utility. The existing utility has sufficient surplus capacity to enable it to supply all the demands of the territory here under consideration, and there is not enough business in sight to permit both the existing utility and the petitioner to earn a reasonable return."

The Sierra Electric Power Company applied to the commission for a certificate that the present and future public convenience and necessity required and will require the construction by it of a hydroelectric plant and system and exercise by it of certain rights and franchises granted to Albert C. Agnew by Butte, Colusa, Glenn, Shasta and Tehama counties, which franchises are claimed to have been assigned to the Sierra company. The company informed the commission that it owned certain water rights in north and south Digger Creeks, Rock Creek and Digger Creek in Shasta and Tehama counties, and owns land adjacent and that it intended to build its plants on Digger Creek and to transmit electric energy to certain area of the counties named. At present the company owns no producing plant and no transmission or distributing system. The company proposes to spend $825,000 for its entire project, and to sell bonds of the face value of $1,000,000 to raise this sum.

The commission's opinion says that Tehama, Glenn and Colusa counties are now served by the Northern California Power Company, Consolidated, and by the Pacific Gas & Electric Company. At the hearing of the petition of the Sierra company, that corporation indicated that it did not intend to enter Butte or Shasta counties at the present time, but both those counties are also served by the Pacific Gas & Electric Company or the Northern California Power Company, Consolidated. The opinion says that no evidence was presented to show that the rates of either of these companies are unreasonable or their service not satisfactory, and that there can be no question but that both these companies are in a position to serve, upon short notice, all demands for power which exists or may develop in the immediate future.

As to the franchises under which the Sierra company proposes to do business, the opinion says that all of them are subject to forfeiture. They were granted subsequent to March 23, 1912, the effective date of the public utilities act. Mr. Agnew did not secure the consent of the commission to their assignment, the little work done under them has been in violation of the public utilities act, and as the franchises provide that work must be commenced under them in good faith within not more than four months of their effective date, and completed within three years, the franchises are without effect.

The Sierra Electric Power Company was incorporated in 1908, with an authorized issue of $500,000. It claims to have expended $78,149.21 for water rights, power and pipe lines, attorneys' fees, etc.

The present company acquired the properties of the former company in 1911, and was authorized to issue $3,000,000 of capital stock. It paid for the property of its predecessor all this stock but ten shares, and also $25,000 in cash. Later 149,939 shares of the stock were returned to the treasury of the Sierra Electric Power Company.

"Their par value, $1,499,390, now erroneously appears on petitioner's books as working capital. Petitioner does not have a dollar of real money as working capital, and its reports should be corrected accordingly," says the Railroad Commission's opinion.

Of this capital stock $1,400,000 and the entire authorized bond issue of $3,000,000 are pledged for security for the payment of the Sierro company's note of $25,000 to William Bayley, which matured on Nov. 15, 1913, and has not been paid.

"Petitioner herein, during the five years subsequent to the acquisition of its predecessor's property in 1911, expended the total sum of $25,208.78," says the opinion, "and has obligations, besides the $25,000 note, of $25,208.78, and has no income."

The company proposed an issue of $750,000 of 6 per cent bonds to sell at 90 per cent of face value. The Railroad Commission says that it is entirely unreasonable to assume that the bonds could be sold for more than 80 or 82½, which would mean a $1,000,000 issue to raise $825,000, the assumed cost of the entire project of the company.

Electric Trucks in New York City.—A recent investigation made of the trucks in use in New York City disclosed the fact that 45 per cent are electric.

New Plant for Philadelphia's Suburbs.—Philadelphia Suburban Gas & Electric Company will build a new power plant at Cromby to cost about $500,000, to be used for service for the towns of West Chester, Pottstown and vicinity.

Patent Granted for Incandescent Lamp that Gives Out Light After Current Is Turned Off.—A patent has been granted, No. 1,200,040, for an incandescent lamp the stem of which contains a luminous compound designed to give up, after the current is turned off, light that was stored in it while the lamp was burning.

Electric Signs for Presidential Campaign.—Two political electric signs erected in Louisville by the Federal Sign System, Electric, feature the gorgeously-plumaged Democratic rooster, on which projector lights are trained at night, with text picked out in lamps. The local Republican organization in the same city has erected a "Hughes and Fairbanks" sign on one of the Federal boards on Fourth Street.

Parents Work While Children Play and Lamps Burn.—An interesting use of electric lighting has been reported by the Durham (N. C.) Traction Company. The Durham hosiery mills have been working over hours and in many cases both parents are employed because of the rush. In order to make it possible for those having children to work overtime, the company arranged a playground and illuminated it with incandescent lamps. This enables the children to romp during the night until their parents' work in the mills is finished.

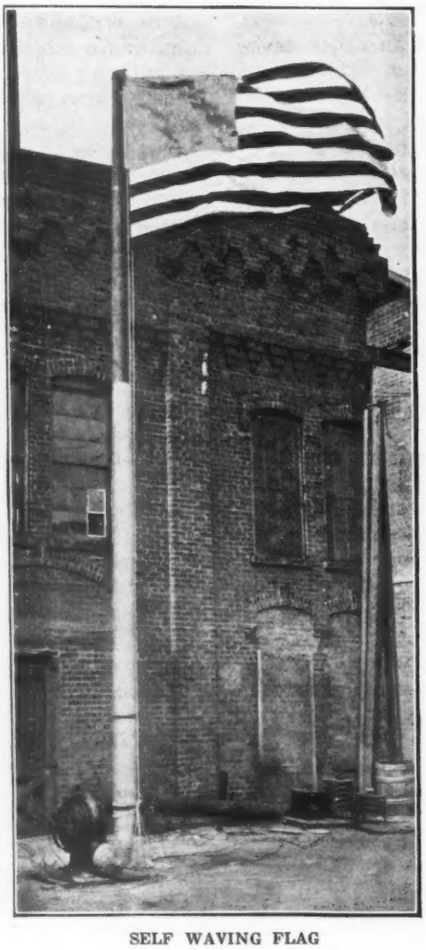
Plant Hauls Water in Tank Cars During Drought.—A water shortage is being experienced by some of the plants in the Ohio Valley at a distance from the Ohio River. In some of the smaller towns where there is no public water supply, and where the plants are dependent on creeks or springs, drying up of these sources has made it necessary to haul water from better supplied points. The Louisville & Northern Railway & Lighting Company, which operates the light plant at Charlestown, Ind., has been hauling water in tank cars from Jeffersonville.

Examination for Expert Electrical and Mechanical Aid.—The United States Civil Service Commission announces an open competitive examination on Nov. 14 for expert electrical and mechanical aid, for men only. From the register of eligibles resulting from this examination certification will be made to fill a vacancy in this position at $12.48 per diem, in the Bureau of Yards and Docks, Navy Department, Washington, D. C., and vacancies as they may occur in positions requiring similar qualifications, unless it is found to be in the interest of the service to fill any vacancy by reinstatement, by transfer or by promotion.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

A Flag That Waves Without a Breeze.—A flagpole by means of which a flag may be made to wave continually without a breath of air stirring has been designed by the illuminating engineering laboratory of the General Electric Company for the Atlantic City electric railway convention exhibit. The accompanying illustration shows the equipment as temporarily erected in a yard at the factory and without a large bronze ball in which the pole will terminate. The pole is a metal tube 27 ft. high and 5 in. in diameter at the top and 9 in. at the bottom. It is set over the exhaust port of a 2-hp. electric motor-driven blower, to be inclosed in a wooden box having at one end a section built up as a supporting guide for the mast. For a distance of 9 ft. from the top of the pole it is perforated with two rows of 0.5-in. holes drilled 1.5 in. apart. When the blower is in operation the blasts emitted through these holes hold the flag and impart to it the waving motion suggested in the illustration.



SELF WAVING FLAG

Largest Electrical Brooding Plant.—A couple of weeks ago the Great Western Power Company turned on energy for a new brooder house at Santa Rosa, Cal., thus connecting what is reputed to be the largest electrical brooder installation in this country. The capacity of the plant at this time is 14,000 chicks. This, however, will be increased until it has a total capacity of 30,000 chicks.

Franklin Institute Program of Lectures.—The program of lectures for 1916-1917 of the Franklin Institute has recently been printed. The list contains the following lectures, which should be of particular interest to electrical men: Oct. 18, "Scientific Research in Relation to the Industries," by Charles P. Steinmetz, General Electric Company, Schenectady, N. Y.; Nov. 9, "The Fundamental Principles of Good Lighting," by P. G. Nutling, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.; Nov. 23, "The Electric Strength of Air and Methods of Measuring High Voltage," by John B. Whitehead, Johns Hopkins University; Dec. 14, "The Cooling of Water for Power-Plant Purposes," by C. C. Thomas, Johns Hopkins University; Feb. 8, "Modern Dynamo Electric Machinery with Special Reference to Power and Traction Uses," by Alexander Gray, Cornell University; March 8, "Dielectric Losses in Insulating Materials," by C. E. Skinner, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.; April 12, "The Electron Theory," by William Albert Noyes, University of Illinois.

Competition for Uncommercialized Electrical Inventions.—For the purpose of discovering and fostering the development of uncommercialized inventions in the electrical field a prize competition has been arranged in connection with the New York Electrical Exposition and Motor Show. All electrical inventions which have not been commercialized are eligible and three prizes will be awarded. Several prominent scientists have been invited to act as judges and their acceptances are assured. The competition closes at midnight, Oct. 13. Participants must present a working or other model which will show the actual operation of their inventions. In announcing this competition, President Arthur Williams of the Electrical Exposition, says: "I believe that there are many valuable inventions in the electrical field which are virtually shelved because of the lack of an opportunity to present them. Our purpose is to discover and foster these. All inventions that are worthy will be properly brought to the attention of those interested in their development, which is possible through the fact that the entire electrical industry of the United States is interested in our Electrical Exposition and Motor Show. In arranging this competition we have been influenced by the fact that many of the famous inventions which have contributed so much to electrical development have lain dormant for varying periods, some counted by years, and the progress of the modern world delayed correspondingly."

Jackson Jovians Get Together.—Members of the Jackson (Mich.) Jovian League held their first "get together" meeting on Oct. 6.

Southeastern Section, N. E. L. A. Meeting.—The annual meeting of the Southeastern section of the National Electric Light Association will be held Nov. 8, 9 and 10 at Tampa, Fla.

Dallas Electric Club.—Directly after the regular luncheon meeting on Sept. 22 the members of the Dallas Electric Club and Jovian League visited the Armstrong Packing Company's plant.

Toronto Section, A. I. E. E., Meetings.—The next meeting of the Toronto Section, A. I. E. E., will be held on Oct. 20. An address on "Accident Prevention" will be delivered by Charles B. Scott. A meeting was held on Sept. 22, when H. M. Hobart read a paper entitled "Electrical Machinery Specifications Based on Modern Standards."

Radio Engineers Meet.—A meeting of the Institute of Radio Engineers was held on Oct. 4 in the Engineering Societies Building, New York City. Edwin H. Armstrong presented a paper on "The Heterodyne Theory of Amplification and its Relation to the Oscillating Audion." The paper was an extension of the valuable results laid before the membership of the Institute by Mr. Armstrong in 1915.

St. Louis Jovians.—The Jovian League of St. Louis at a luncheon at the American Annex on Oct. 3 formulated plans for gathering statistics relating to the cost of electrifying the railroad deck of Eads bridge and the Terminal tunnel, as proposed by Director of Public Utilities Hooke, and the benefits that might accrue to the city. At the next meeting of the league C. E. Smith, chief consulting engineer, who drafted the data on which Director Hooke's recommendations were made, will speak on "Electrifying the Eads Bridge."

Joint Meeting New York Sections N. E. L. A. and I. E. S.—There was held on Oct. 11, at the Auditorium of the Consolidated Gas Company, a joint meeting of the New York Sections of the National Electric Light Association and the Illuminating Engineering Society. The subject of the meeting was "Preparedness." W. S. Gifford, supervising director of committee on industrial preparedness, spoke upon the work of that committee. Major-General Leonard Wood was also named among the speakers.

Joint Meeting of Pittsburgh Sections of Institute and Iron and Steel Engineers.—There will be held on Oct. 21 at the Fort Pitt Hotel, Pittsburgh, Pa., a joint meeting of the Pittsburgh sections of the A. I. E. E. and the Association of Iron and Steel Electrical Engineers. An abstract of the central station power committee's report presented at the Chicago convention of the A. I. and S. E. E. will be read, followed by two papers, one by H. B. Dwight on "Steel Conductors for Transmission Lines" and the other by David Hall, entitled "The Advantages of Modern Types of Direct-Current Machines."

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

Schenectady Section A. I. E. E.—The 175th meeting of the Schenectady section of the A. I. E. E. was held at the Edison Club Hall on Oct. 6. After an opening talk by E. W. Rice, Jr., president of the General Electric Company, the meeting was addressed by O. D. Young, vice-president of the company, on the subject, "The Relation of Large Companies to Industry and the Relation of the Individual to the Large Company."

Pacific Jobbers Hold Meeting.—The annual meeting of the Electrical Supply Jobbers' Association of the Pacific Coast was held at Hayden Lake, Idaho, Sept. 21, 22 and 23. Although no set papers were presented, various topics were discussed informally. The debate around which greatest interest centered was that on the problem of slow-moving stock, which is a vital question on the Pacific Coast. The question as to whether it is more profitable for jobbers to carry fast-moving, low-profit stock or slow-moving, high-profit stock was presented from both viewpoints, Mr. Will, of the Fobes Supply Company of Portland, leading the debate on the slow-moving stock side and Harry Burns leading on the side of the low-profit stock. In accordance with the usual custom, no decision was sought as a result of the discussion.

Power Limiting Reactors Discussed at Rochester.—Prof. John C. Parker, head of the department of electrical engineering in the University of Michigan, formerly chief electrical and mechanical engineer of the Rochester Railway & Light Company, addressed the Rochester section of the American Institute of Electrical Engineers on Sept. 24 in Selby Hall. Mr. Parker chose as his subject, "Some Little Recognized Factors in the Use of Power-Limiting Reactors." A general discussion followed the lecture, in which Roger De Wolf, mechanical engineer of the Rochester Railway & Light Company; Walter S. Burch, assistant engineer of the same company; Ivar Lundgaard, manager of the industrial sales department of the same company, and Lucien Buck, purchasing engineer of the Eastman Kodak Company, entered.

Philadelphia Institute Meeting.—The 325th meeting of the American Institute of Electrical Engineers was held in Philadelphia on Friday of this week at the Bellevue-Stratford Hotel under the auspices of the Philadelphia section and the power stations committee of the institute. There were two technical sessions, one in the afternoon and the other in the evening. At the afternoon session C. L. Eglin presented a paper on "The Power Company's Problem in the Electric Supply for Large Single-Phase Load" and Philip Torchio read a paper entitled "Supply of Single-Phase Loads from Central Stations." Two papers were presented at the evening session, one by E. F. W. Alexanderson and G. H. Hill, entitled "Single-Phase Power Production," and the other by R. E. Gilman and C. L. Fortescue on "Single-Phase Power Service from Central Stations."

Engineers Meeting Reaches High Mark in Attendance.—Because the dining room of the City Club of Chicago can seat but 250 people it was necessary to turn away some engineers from the second annual booster dinner of the American Association of Engineers on Oct. 6. Prof. C. Francis Harding of Purdue University, the speaker of the evening, had chosen for his subject, "Marketing Engineering Ability." In his address he analyzed the popular criticism of technical graduates and suggested that encouragement of the use of good English, both spoken and written, cultivation of tact and executive ability in young engineers, and the promotion of education in modern business methods would aid in lifting the engineer from the slough. Other speakers of the evening brought out the fact that since its first booster dinner a year ago the association has increased its membership from 200 to 1200. Every state in the Union now contains members.

Fall Meeting of Western New England Electrical Inspectors.—The Western New England section of the National Association of Electrical Inspectors held its fall meeting, on Oct. 10, at the Pond House, Elizabeth Park, Hartford, Conn. The following program was scheduled to be carried out: Morning—Address of welcome by Guy E. Beardsley, president of the Hartford board of fire underwriters; response by L. N. Heebner, chairman of the Northern Connecticut group; routine business. Consideration of suggestions for changes in the 1917 edition of the National Electrical Code. Exhibition of defective electrical devices and infractions of the rules in the National Electrical Code. Afternoon—"The Use of Plated Iron and Steel Parts in Wiring Devices," past national President Thomas H. Day presiding; "The Viewpoint of the Underwriters' Laboratories," Dana Pierce; "The Viewpoint of the Manufacturers," H. T. Paiste; "The Viewpoint of an Electrical Inspector," A. W. Hopkins, inspector of wires, Springfield, Mass.; a composition discussion, in which the following were scheduled to take part: Shiras Morris, president of the Hart & Hegeman Manufacturing Company of Hartford; F. T. Wheeler, vice-president of the Trumbull Electric Manufacturing Company of Plainville; F. L. Furgerson of the Hessel-Hoppen Company of New Haven. "The Work of the Electrical Department of the Underwriters' Laboratories," an illustrated address by Dana Pierce; question box; short business session, with announcement for winter meeting, which is to be held on Jan. 10, 1917.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

JULY ELECTRICAL EXPORTS

Month's Trade of Approximately $3,000,000 Brings Total for First Seven Months of 1916 Up to $19,930,130

During July last there were exported electrical goods to the value of $2,993,857 as compared with $2,146,526 during July, 1915. The July, 1916, exports of generators, carbon lamps, meters, telephones and transformers were less than those for July, 1915. Exports in the other listed articles showed gains.

The principal gains in comparison with last year were in batteries which showed an increase of almost $60,000, insulated wire and cable which showed an increase of $183,000, tungsten lamps which showed an increase of over $500,000.

July's exports brought the total for the first seven months of the current year up to $19,930,130 in comparison with $13,170,367 for the first seven months of 1915, and $12,630,599 for the corresponding period of 1914. While there have been appreciable increases during the January to July period of 1916 in comparison with former years in the export of the individual items, with the exception of generators, fans, interior wiring supplies, arc lamps, and carbon lamps, there has been nothing remarkable in any of these except the miscellaneous equipment. This item for the seven months of the year amounted to $9,503,171 in comparison with $5,321,435 and $5,466,431 for the corresponding periods of 1915 and 1914 respectively.

EXPORTS OF ELECTRICAL MERCHANDISE BY ARTICLES

	July		Seven Months Ended July	
Articles	1915 Value	1916 Value	1915 Value	1916 Value
Batteries	$91,344	$149,512	$749,485	$1,012,490
Generators	156,191	131,597	1,232,617	804,793
Fans	28,438	28,395	215,268	197,305
Insulated wire and cable	187,379	370,378	1,513,217	2,091,346
Interior wiring supplies, etc., including fixtures	80,933	82,952	555,964	494,077
Arc lamps	433	803	15,212	10,292
Carbon filament lamps	9,712	3,738	80,199	60,282
Metal filament lamps.	55,932	165,132	346,476	872,527
Meters and other measuring instruments	55,463	46,486	338,993	449,268
Motors	380,934	409,474	1,765,685	2,734,786
Telegraph instruments (including wireless apparatus)	8,536	23,839	57,653	84,602
Telephones	101,338	74,162	632,079	1,023,626
Transformers	73,231	62,699	346,084	591,065
All other	916,662	1,144,690	5,321,435	9,503,171
Total	$2,146,526	$2,993,857	$13,170,367	$19,930,130

Based on the figures for the first seven months it is estimated that the exports of electrical goods during 1916 will amount to $34,000,000.

As has been repeatedly pointed out in the past the comparisons above are for values only, and since prices this year are not comparable with prices for previous years the comparisons are apt to be misleading. The actual volume of trade is considerably less than is indicated by the accompanying figures in comparison with figures for previous years. In fact, in some instances where 1916 figures apparently show a very appreciable increase over 1915 there is in reality an actual decrease in the volume of goods.

Take, for instance, insulated wire and cable. During the first seven months of 1916 the exports of this material were valued at $2,091,846, and in 1915 at $1,513,217, an apparent gain of almost 40 per cent. Actually, however, bare copper wire sold during the first seven months of 1916 at over 30 cents, while the price during the first seven months of 1915 ranged from around 15 cents to 22 cents, or an average of about 18.5 cents. The increase in price must, therefore, be at least 60 per cent to cover increased cost of the copper wire. Insulated wire increased still more in cost owing to labor conditions and to the insulation market. This is but one of the instances where apparent increases in exports are actually decreases.

The accompanying table was compiled by the Bureau of Foreign and Domestic Commerce, and appeared in the monthly summary of the bureau for July.

ELECTRICAL MACHINERY PRICES

Feeling Exists that Maximum Has Been Reached Although no Decrease Can Be Expected for Some Time

Starting with the fall of 1915 there has been until lately an almost steady succession of advances in prices on electrical machinery. Motors were the first to feel the advance, 10 per cent being added to the price about a year ago. As the demand for other types of apparatus was seen to increase to the factory capacity taxing point price advances followed. Not one advance was levied but many. In no case, however, has any evidence been found that the advance was supposed to be a measure of the demand. The market was not taxed according to what it could or would bear. In every case records point out that the increase was fully justified by the rising cost of manufacture. Labor and metals have advanced many per cent, the former about 25 per cent and the latter in the neighborhood of 100 per cent. Every effort was made to reduce the cost of production, but it is evident that with the above conditions existing a considerable advance would be necessary in prices to assure a satisfactory profit.

During the recent weeks there has been no evidence of prices making any further advance, and in view of the condition of the market there is a rather definite feeling that the peak in prices has been reached. There may still be some isolated cases of advance to come where conditions demanding such a course arise, but generally speaking it is not believed that prices will go any higher.

On the other hand, there is nothing to lead buyers to expect any appreciable reductions for some time. As was predicted by the ELECTRICAL WORLD when the signs of an advancing market first became evident, prices will undoubtedly remain at this peak for some months, probably at least a year, after which any reduction in the price curve will undoubtedly be gradual.

Manufacturers of electrical machinery are sold up 'way into 1917. They are in most departments in the position of not being able to handle new orders except at practically prohibitive deliveries. Buyers, therefore, are simply waiting for the release of some portion of the manufacturing capacity for new business. At the present prices there is a sufficient volume of orders awaiting fulfillment to keep the factories working at maximum production to the end of 1917 at least. Under such a condition and further considering that the raw materials going into these products were bought at the present prices it can well be appreciated why there is little possibility of any decrease before 1918.

Further than that it is not possible to hazard an opinion on which any reliance could be placed. It is certain practically that all metals are going higher, some of them higher than ever before. In the face of this, however, it is known that several of the more prominent electrical manufacturers have foreseen such rises and have purchased large and adequate supplies for delivery well into 1917 at prices considerably below what they undoubtedly will be in a few

months' time. On the other hand, it is felt to be equally true that the manufacturers will not regulate their prices according to the raw material market at the time of sale, but rather according to the market at the time the metal was ordered. This is because the manufacturers feel that they are an integral part of the electrical industry, and that any unnecessarily high prices at this time will react disadvantageously to the industry later.

Of course, should the metal market advance to unheard-of prices at the time when stocks were low the manufacturer naturally would be forced to make further advances. This, however, is unlikely, for it is well appreciated that the metal market is like the swing of the pendulum. There is no steady advance to the highest prices, but rather an advance part way and then a falling back followed by another advance, etc.

PACKING MATERIALS HOLD UP DELIVERIES

Lumber, Cardboard, Fiber and Other Materials Are Difficult to Obtain and Prices Are Greatly Advanced

In addition to a scarcity of raw materials for their products manufacturers are face to face with a serious shipping problem in the matter of packing materials. These materials are scarce and in some instances are holding up deliveries. Lumber, fluted cardboard, fiber and other packing materials are hard to obtain, and prices have advanced materially.

The amount of lumber used each year in crating machinery and for packing boxes in the industry is enormous. In many electrical lines it has been superseded by fluted cardboard, but events of the last year or so, it is understood, have disturbed this supply also.

ELECTRICAL EXPORTS TO SOUTH AMERICA

Ratio to Total Exports of Electrical Merchandise of Domestic Manufacture Over Twelve Month Period Is 14.3 Per Cent

Contrary to a rather deep-rooted opinion that South America is the greatest foreign market for electrical goods of American manufacture, is a compilation made by the ELECTRICAL WORLD. The compilation shows that over the twelve-month period from October, 1915, to September, 1916, electrical exports to South America amounted to $4,757,000 against $33,427,866 the total exports. The ratio therefore of exports to South America compared with the total exports of electrical goods is 14.3 per cent.

During this period, as shown in the accompanying table, the largest month for exports to South America was August last, when $720,000 worth of electrical merchandise was shipped to the Southern republics. In this month the export ratio rose to 24 per cent. In other months, however, it has fallen below 10 per cent.

Figures for the total exports for August and September are not yet available, and therefore had to be estimated.

TABLE SHOWING RATIO OF EXPORTS TO SOUTH AMERICA AS COMPARED WITH TOTAL EXPORTS

Month	South America	Total Exports	Percentage to South America
1915			
October	$322,000	$2,145,594	15.0
November	219,000	2,744,847	8.0
December	456,000	2,177,338	21.0
1916			
January	353,000	2,320,822	15.2
February	340,000	2,942,611	11.6
March	338,000	2,884,875	11.7
April	298,000	2,630,169	11.3
May	303,000	3,437,609	8.8
June	401,000	3,150,144	12.7
July	576,000	2,993,857	19.3
August	720,000	3,000,000*	24.0
September	431,000	3,000,000*	14.4
Total	$4,757,000	$33,427,866	14.3

*Estimated.

INSTALLMENT PLAN BOOSTS ELECTRIC VEHICLE SALE

Plan Under Operation for Year with Pleasure Vehicles Now to Be Extended to Include Trucks As Well

At the Oct. 3 luncheon of the Chicago Electric Vehicle Section, National Electric Light Association, Albert L. Deane, assistant sales manager of the Guaranty Securities Corporation, New York City, outlined the plan under which his company is operating to help the dealers of gasoline and electric vehicles finance the sale of cars on time payments. The plan originated, he said, because it was found that purchasers were buying those cars on which time payments could be secured and thus actually selecting their car on the basis of terms rather than on the merits of the vehicle. He pointed out that the sale of a car on time does not necessarily mean that the purchaser has poor credit and, in fact, he must have very definite credit standing before the Guaranty Securities Company will carry the papers.

According to the Guaranty plan, the transaction is between the dealer and the purchaser and includes a standard form of contract and promissory note from the latter. The Guaranty company then purchases these papers and lends the dealer, who must indorse the note, 90 per cent of the face of the note at once. The 10 per cent, which is withheld twelve months, or over the period of payment, draws 6 per cent interest for the dealer, and while the cost to the buyer is 6 per cent interest on the contract, there is no cost to the dealer. The buyer must pay 25 per cent of the list price of the car, plus the Guaranty Securities Company's charge as his payment down, and the balance in twelve equal payments. This charge is 5 per cent of the list price when this is more than $1,500, and includes fire, theft and collision insurance for one year. This 5 per cent represents a cost to the buyer of 0.4 per cent more than he could buy the same insurance for in the open market and is the profit margin to the Guaranty company.

During the past year the corporation has operated this plan to include twenty-two makes of gasoline pleasure cars and all makes of electric pleasure cars and has purchased $16,000,000 worth of notes from dealers covering car sales, and it reports prompt payment and no losses. In the 12,000 car sales handled in this way, there have been only nine cases where the dealers had to take repossession of the car, and in each of these cases he made an additional profit by resale. Mr. Deane said in connection with the advertising campaign which the corporation is carrying on to promote the deferred payment plan without reference to any particular makes of trucks or pleasure cars, that inquiries were coming in at the rate of 4000 and over a day which were being turned over to Guaranty dealers. In a study of the results obtained by dealers using the Guaranty plan with their customers, Mr. Deane had 700 letters from dealers which showed from 75 per cent to 700 per cent increase in business due to the use of the Guaranty plan system. Other data he had showed that 64 per cent of the sales which were made through the use of the deferred payment plan would not have been possible had it not been for this convenience. It was pointed out that while the contract is assigned to the Guaranty company and reverts back to the dealer because of his indorsement if the buyer fails to pay, yet in only nine out of 12,000 cases had the dealer found it necessary to take repossession.

The deferred payment plan is operated without the use of a chattel-mortgage against the car, except in three States which require it, but the dealer is given absolute protection by a clause in the insurance contract which protects the dealer against theft or mortgage against the car by the buyer. The plan simply extends a dealer's credit six times, since the Guaranty Securities Corporation will buy up contracts from him to five times his credit rating, and yet this in most cases does not impair his full credit standing at his bank.

The extension of the plan to include electric and gasoline trucks of all kinds is already being tried out in New York City, and it is anticipated that since the negotiations will be with firms having a clearly established financial standing, that the plan will meet with even greater success than in the pleasure vehicle field.

Manufacturing and Industrial

Foreign Trade Letter.—The first of a series of foreign trade letters has just been received from the First National Bank of Boston.

The Line-a-Time Manufacturing Company, Inc., has removed its New York office to 277 Broadway, New York City. The former address was 90 West Broadway.

The Roller-Smith Company announces that it is now represented in Birmingham, Ala., by Jonathan Haralson, Brown-Marx Building, who will handle Roller-Smith instruments, circuit breakers and Columbia meters.

The Hess-Bright Manufacturing Company, Philadelphia, Pa., announces that B. D. Gray has been elected president to succeed F. E. Bright. Mr. Bright remains identified with the company as chairman of the board of directors.

$500,000 Apartment Building to Have Electric Ranges.—What is said to be one of the finest apartment houses yet constructed on the Pacific Coast, now being built in Los Angeles, will be equipped with thirty-nine No. 50 Hughes electric ranges.

The Pyrene Manufacturing Company, 52 Vanderbilt Avenue, New York City, manufacturers of fire extinguishers, has recently increased its line of products by including a complete outfit of fire-fighting appliances for use in all cases except for large vehicles and places where sprinkler systems are installed.

The H. W. Johns-Manville Company has just opened a new branch office at Great Falls, Mont., at 418 Ford Building, in charge of J. H. Roe. With the opening of the Great Falls office the company increases its number of branches to fifty-five. The new branch is made necessary by rapidly increasing business in this territory.

Judges on Western Electric Fan Display to Meet on Monday.—The board of judges on the 1916 fan window display contest conducted by the Western Electric Company will meet in New York on Monday, Oct. 16. O. H. Caldwell, assistant managing editor of the ELECTRICAL WORLD, will represent that paper on the board.

General Insulate Company, 1008-1014 Atlantic Avenue, Brooklyn, N. Y., molders of Insulate products and "Hi-Heet" specialties, announce the appointment of Bailey-Drake Company, 236 Title Insurance Building, Los Angeles, Cal.; 149 New Montgomery Street, San Francisco, Cal.; Denham Building, Denver, Col.; Maritime Building, Seattle, Wash., as their agent in that section.

Argentina to Manufacture Incandescent Lamps.—A recently organized company is initiating the manufacture of electric lamps in Argentina. This company, which operates under the name of La Compañía Argentina de Lámparas Eléctricas Z, has imported machinery and apparatus for its plant, and expects to be able to offer the public in October the first electric lamps of Argentine manufacture.

Test on Electric Fire Alarm System.—A test on the efficiency of the automatic fire alarm system installed on Pier 7 on the Lackawanna Railroad Company at Hoboken, N. J., was made on Tuesday, Oct. 3. The test was made for the benefit of the Railway Fire Protection Association delegates. A small amount of excelsior was set on fire, and in thirty-five seconds the detector located nearest the fire gave the alarm. These detectors are manufactured by the Metropolitan Electric Protective Company, 130 West Twenty-sixth Street, New York City.

Junior Range Campaign Starts.—The Western Electric Company has started its second campaign on the "Junior" electric range. The range was first brought out last year and met with a great success. This year's range is the duplicate of that brought out last year. The general publicity campaign includes a half page in the *Saturday Evening Post* and two full pages in *St. Nicholas.* Cut-outs, stuffers and other dealer helps will be furnished by the Western Electric Company, which states that to all indications the 1916 campaign will eclipse that of 1915.

Fiery Trial for Lamp Guards.—W. N. Matthews & Brother of St. Louis have in their possession an exhibit of a lamp guard which they state substantiates their claims for long life. E. P. Winters, chief electrician of the Woodward (Ala.) Iron Company, supplied the evidence as follows: "I have a 'Hold-Fast' lamp guard that has gone through a by-product coke oven and has come out undamaged and is almost entirely inclosed in coke. It strikes me as a rather interesting specimen, and if you like to have it I will send it to you by express." Needless to say the offer was accepted by the St. Louis company.

Stanley & Patterson, Inc., New York, announce that they have purchased the entire business, trade marks, patents, finished stock, stock in process of manufacture, and goodwill of the P. R. Manufacturing Company of Detroit, Mich. The plant is being moved to New York and consolidated with the Stanley & Patterson plant, which has heretofore been devoted to the manufacture of Faraday signal gongs. Mr. Proctor of the P. R. Manufacturing Company will be associated with Stanley & Patterson and in direct charge of manufacturing. Stock on hand and in process of manufacture will permit reasonably prompt shipments of most of the standard P. R. lines.

Holiday for His American S. K. F. Employees.—On Saturday, Sept. 23, Sven Winquist of Gothenburg, Sweden, inventor of the S. K. F. ball bearing, visited the new American factory of the S. K. F. Ball Bearing Company at Hartford, Conn. Mr. Winquist is president of the Swedish company and a trustee of the Connecticut company. After inspecting the factory he expressed himself as very much pleased with the splendid start made. The American factory is already producing more bearings than its rated capacity and Mr. Winquist stated that large additions to the present buildings would soon be necessary.

Mr. Winquist was very much gratified to see that the quality of the product of the American factory was being maintained. The raw material for the bearings—Swedish crucible steel—is imported and the same manufacturing methods are used at Hartford as in Sweden. As soon as Mr. Winquist and his party had finished their inspection of the factory he posted a notice stating that in appreciation of the excellent work done by the Hartford factory during the past few months, Saturday, Sept. 30, would be a holiday with full pay.

British Companies Establish Electrode Plant.—The recent installation of a number of electric furnaces in Sheffield has led to an increased demand for electrodes. Prior to the war the electrodes used in this country were bought principally in the United States, although some came from the Continent. The entire supply now comes from the United States, except those used by one firm, which manufactures only for its own requirements. The Electrode Company of Sheffield, Ltd., has been organized with a capital of £50,000, or $243,325, for the manufacture of carbon electrodes, and a plant is being built which it is expected will be in operation within the next three months. The promoters of this company and the majority holders of the stock are four large Sheffield manufacturing firms, which have installed or have in process of installation 23 electric furnaces, with a total capacity of 905 tons. The new company will have an output of from 3000 to 5000 tons of carbon electrodes per annum. The primary object is to furnish the promoters with an adequate supply of electrodes for their own furnaces, although any surplus manufactured will undoubtedly be put upon the market.

NEW YORK METAL MARKET PRICES

	Oct. 3 Selling Prices Bid	Oct. 3 Selling Prices Asked	Oct. 9 Selling Prices Bid	Oct. 9 Selling Prices Asked
Copper	£ s d		£ s d	
London, standard spot	119 10 0		121 0 0	
Prime Lake	28.25 to 28.50†		28.25 to 28.50†	
Electrolytic	28.50 to 28.75†		28.50 to 28.75†	
Casting	26.50 to 27.00†		27.12½ to 27.37½†	
Copper wire base	33.00†		33.00†	
Lead	7.00		7.00	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	15.00		15.00	
Spelter spot	9.55 to 9.67½		9.92½ to 10.17½†	
Tin straits	38.50		42.75	
Aluminum, 98 to 99 per cent	61.00 to 62.00		61.00 to 63.00†	

OLD METALS

Heavy copper and wire	22.50	to 23.00†	23.00	to 23.50†
Brass, heavy	13.25	to 13.50†	13.50	to 13.75†
Brass, light	10.00	to 10.50†	10.25	to 10.75†
Lead, heavy	5.87½	to 6.00†	5.87½	to 6.00†
Zinc, scrap	6.50	to 6.75†	6.75	to 7.00

COPPER EXPORTS

Total tons to Oct. 9	5,225

†Nominal.

PUBLIC UTILITY BONDS FOR SAVINGS BANK INVESTMENT

Investment Bankers Committee on Public Service Corporations Make Recommendations at Cincinnati Convention

After recommending public utility bonds as a means of investment for savings banks where there is little opportunity for taking up new real estate mortgages the public service corporations committee of the Investment Bankers' Association in its report at the annual convention at Cincinnati last week presented the result of its year's investigation in this field.

The report quoted in part follows:

"In regard to the kinds of utilities which afford a suitable field for savings bank investment, your committee believes it is advisable, for the present at least, to include only companies furnishing artificial gas, electric light and power, local transportation and telephone and telegraph service to the public.

"The committee, after some study of various utility properties and the market for their securities, would suggest that companies must have at least $500,000 gross earnings in order that their securities may qualify for investment. This, also, has been a matter of some experimenting in order to place the requirements at the proper point; and it has been found that companies of this size usually operate in substantial centers of population and have a substantial amount of property investment. Further, companies with earnings of the above amount usually require bond issues of a size which insures a considerable distribution and consequently a better market than is possible with smaller issues. As in other cases the decision must be arbitrary, but it is believed that $500,000 gross earnings fairly marks the point where the advantages of a well-established market for the securities of a corporation may be expected to exist.

"The committee would suggest, in order that there may be assurance that earnings are derived from a general distribution of service as the law intends, that if 10 per cent or more of the gross earnings is derived from any one customer the revenue from that customer shall be excluded in determining the size of the corporation for this purpose of qualification.

"In regard to telephone companies the committee believes that gross earnings of at least $1,500,000 should be required in order to give the assurance that a company occupies either a large and permanent center of population or else covers a large area so as to include a proper field for long-distance communication and give a full telephone service, long distance as well as local.

"The committee suggests that investment should be limited to companies located within the United States, and believes that investment can to advantage be further limited to those States only which have public utility commissions with powers of protection of utilities and their investments. It is believed that sufficient protection is afforded where a commission, through control of rates, can assure to a company a fair return on its property investment, honestly and prudently made, and where the laws provide that any new utility must obtain a certificate of public convenience and necessity from the commission before starting in business. Consequently, the committee suggests the further restriction of investment to utilities located in States which give such protection.

"The committee suggests that in selecting the securities of companies which qualify for investment, the principle should be followed of allowing only bonds which are secured by a direct lien on operating property from which the company's gross earnings are derived, and are the direct or assumed obligations of the company which qualifies, or are bonds of leased and operated properties guaranteed as to both principal and interest by indorsement by such a company.

"This limits investment to mortgage bonds, except that the committee believes that an exception may safely be made in the case of a bond issue secured by entire issues of first mortgage bonds of operating properties whose gross earnings are included in a company's statement of gross earnings, as such an issue would give in effect a first lien on operating property."

Corporate and Financial

Cities Service Company, New York, N. Y.—The directors of the company last week passed the following: "That until such time as there has been invested in the property of the Cities Service Company, or its subsidiaries, from the earnings of the company, a sum equal to the entire par value of the preferred stock then outstanding, there shall be no dividends paid in cash on the common stock in excess of 6 per cent per annum, unless the company shall, for a period of six months, have purchased and retired all preferred stock that can be purchased in the open market at 110 per cent or par or less. That until the foregoing has been complied with, no surplus or portion of surplus created by an increase due to the revaluation of assets, already carried on the books, may be used as a basis for the distribution of cash dividends on the common stock." The actual earnings of the properties now controlled by the Cities Service Company for the past twelve months are sufficient to pay 6 per cent in cash on both classes of stock and leave earnings in excess of $6,000,000 to be put into the property. Up to Aug. 31, there has been put back into the company from earnings in excess of cash dividends $8,400,000.

Kentucky Utilities Company, Lexington, Ky.—President Harry Reid has announced that his company has purchased the electric lighting plants at Morganfield and Uniontown, Ky., recently reported sold. The Kentucky Utilities Company will shortly acquire other plants, Mr. Reid stated.

Northwestern Electric Company, Portland, Ore.—It has been announced that the company has completed the distribution of $500,000 additional of 6 per cent preferred stock.

Pacific Gas & Electric Company, San Francisco, Cal.—The California Railroad Commission has issued an order authorizing the Pacific Gas & Electric Company to issue $659,000 general and refunding mortgage bonds, to net not less than 85 per cent, and the proceeds to reimburse the company for expenditures from income for the retirement of $560,000 of its bonds. The company paid to the Mercantile Trust Company of San Francisco, as trustee, $560 000 to retire outstanding bonds of the Oakland Gas, Light & Heat Company, a subsidiary of the Pacific company. The Oakland company had issued bonds in the total sum of $1,000,000. Of this amount $440,000 were redeemed through the operation of a sinking fund, and the balance matured on March 16 of this year, and was duly redeemed. The company stated that it expected to sell the bonds for more than 85 per cent.

Public Service Company of Northern Illinois, Chicago, Ill.—The directors on Sept. 25 declared a quarterly dividend of 1.75 per cent on its common stock, thus increasing the rate from 6 per cent to 7 per cent per annum. A year ago the rate was increased from 5 per cent to 6 per cent. The directors also declared the usual quarterly dividend of 1.5 per cent on the preferred stock. Both dividends are payable on Nov. 1 to stock of record as of Oct. 17.

Southern California Edison Company, Los Angeles, Cal.—By declaring a quarterly dividend of 1.75 per cent on its common stock payable on Nov. 15 to stock of record Oct. 31 the company raises to stock from a 6 per cent basis to a 7 per cent basis. Since the $4,000,000 preferred stock of the company participates equally with the common stock in dividends, which had previously been 5 per cent, the preferred stock automatically is placed on a 7 per cent basis.

The United Gas and Electric Corporation, New York, N. Y.—Earnings of the subsidiary operating companies of the United Gas & Electric Corporation for the twelve months ending July 31, 1916, as compared with the previous year were:

Gross	$14,531,463
Net	6,454,374
Fixed charges	3,473,566
Net after charges	2,980,808

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.—Resolutions have been adopted by the directors calling for payment on Jan. 1 all of the outstanding 5 per cent convertible bonds of the issue of 1915 at 105 and interest. Up to the end of 1916 the bonds are convertible par for par into common stock, but $2,500,000 being unconverted so far. Those not converted by the end of the year will be redeemed.

New Utility and Industrial Companies

The Industrial Electric Company of Rochester, N. Y., has been incorporated by Theodore T. Benz, Edward F. Davison and George W. Brotsch, all of Rochester, N. Y. The company is capitalized at $15,000 and proposes to do a general electrical business.

The Universal Electric Company of Arlington, N. J., has been chartered with a capital stock of $25,000 to manufacture and deal in electric motors, generators, etc. The incorporators are. Carl F. Westlin, Gustav C. Westlin and Frank Koch of Arlington, N. J.

The Baltimore Electric Talking Sign Company of Jersey City, N. J., has been incorporated with a capital stock of $150,000 to deal in signs, electrical and others. The incorporators are: Charles J. Garmley, John H. Patterson and Benjamin R. Gordon of Jersey City, N. J.

The O'Connor Electric Company of Esopus, N. Y., has been incorporated with a capital stock of $5,000 by S. A. O'Neill, A. Conrow and J. O'Connor, 626 West End Avenue, New York, N. Y. The company proposes to manufacture and deal in electric vibrators, immersion heaters, electric devices, etc.

George W. Scherff & Company of New York, N. Y., has been chartered with a capital stock of $10,000 to manufacture and deal in machinery, appliances and devices used in connection with electricity. The incorporators are: G. H. Scherff, C. W. Kemmler, Jr., and H. S. Craig, 17 Battery Place, New York, N. Y.

The Terminal Engineering Company of New York, N. Y., has been incorporated with a capital stock of $50,000 by H. F. Thomson, Richard J. Oearborn and W. C. Brinton, 7 East Forty-second Street, New York, N. Y. The company proposes to do a general electrical, mechanical consulting-engineering business.

The Electrical Machinery & Engineering Company of Pocatello, Idaho, has been incorporated by Herbert R. Bucks, Frank E. Sanders and Charles R. Staymer, all of Pocatello. The company is capitalized at $25,000 and proposes to do a general electrical and mechanical engineering business and to deal in electrical appliances, etc.

The Electro Pneumatic Gear Shaft Corporation of Wilmington, Del., has been chartered with a capital stock of $100,000 to manufacture and sell the MacPherson electropneumatic gear shaft and clutch-brake control for use on motor vehicles of all kinds. The incorporators are: Jonathan H. Brown, William E. Brown and E. Everett, all of Wilmington, Del.

The Gaston, Williams & Wigmore Electrical Engineering Corporation has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $100,000 and proposes to carry on a general electrical engineering and construction business. The incorporators are: M. J. Furlong, A. J. Mace and R. H. Lee Martin of New York, N. Y., and J. A. Wigmore of Cleveland, Ohio.

The American Insulator Company, New Freedom, Pa., has been incorporated under the laws of Pennsylvania for the purpose of manufacturing insulators, particularly in molded shapes for electrical and heat resisting purposes. The number of employees started with is about 125. A die making department with about twenty die makers has been in operation for the last month getting the dies ready for the production of the insulations for which the company has already large contracts. The materials manufactured, it is stated by company officials, are similar to hard rubber products, but serve principally as substitutes for hard fiber and porcelain and are adapted for insulating parts for electrical appliances, automobile lighting and generating systems, gear shift levers, steam valve handles, etc. The plant of the company has 48,000 sq. ft. of manufacturing floor space, all one story brick building, with a steam power plant of 220 hp. and electric generating plant. All departments are operated by individual motors. Incorporators are H. C. Kugler, H. Hendrix, Dr. S. Bowers, Maurice Spector, Ira Painter, Charles Noonamaker, William Ottemiller, Charles Wilde and Emile Hemming, all of York County, Pa. The plant is located on the Pennsylvania Railroad at New Freedom, which it about 30 miles from Baltimore.

Trade Publications

Socket Appliances. — Harvey Hubbell, Inc., Bridgeport, Conn., has prepared a leaflet describing the Hubbell signalite cap.

Electrical Supplies.—The Mohawk Electrical Supply Company of Syracuse, N. Y., has issued a circular on electrical supplies.

Electric Fans.—The Kokomo (Ind.) Oscillating Fan Company has issued an envelope stuffer, entitled "A Breeze from Kokomo."

Lamp Guard.—W. N. Mathews & Brothers, Inc., 3709 Forest Park Boulevard, St. Louis, Mo., have prepared a leaflet on a new lamp guard.

Electric Irons.—A leaflet describing the Reimers regulator electric iron has been issued by the Reimers Manufacturing Company, 130 Church Street, New York, N. Y.

Percolators and Urns.—Landers, Frary & Clark of New Britain, Conn., have issued a well illustrated circular on their "Universal" electric coffee percolators and urns.

Lighting Fixtures.—"Take a Tip" is the title of a leaflet issued by the New York Gas & Electric Appliance Company, 569-571 Broadway, New York City, describing its new Doric units.

Electric Radiators.—"Lee Electric Radiators and Electric Water Heaters" is the title of a booklet prepared by the Lee Electric Radiator Company, 692 Peoples Gas Building, Chicago.

Push Sockets.—"Push Sockets" is the title of an interesting and well-illustrated booklet of twenty-four pages, prepared by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis.

Fuses.—Schweitzer & Conrad, Inc., Berteau and Ravenswood Avenues, Chicago, have issued Bulletin No. 1A descriptive of their S. & C. extra high-potential fuses. The text is well illustrated.

Flasher Cases and Batteries.—The French Battery & Carbon Company of Madison, Wis., has prepared Catalog No. 32 on its flasher cases and batteries and ignition and telephone dry cells. The illustrations are profusely colored.

Water Treatment.—A carefully prepared booklet entitled "Incrustation, Corrosion, Foaming and Other Effects of Water Used in Steam Making and Methods of Prevention" has just been issued by the Dearborn Chemical Company, McCormick Building, Chicago.

Electric Bake Oven.—The Hughes Electric Heating Company of Chicago has just issued a new catalog giving illustrations and specifications of its various types of electric bake ovens. On the back cover are listed the names and locations of some of the 250 firms who have installed the Hughes electric bake oven.

Boiler-Room Specialties. — The Lagonda Manufacturing Company of Springfield, Ohio, has issued a sixteen-page booklet that contains illustrations of the different types of Lagonda tube cleaners and other specialties, one page being devoted to each. The descriptions are brief, reference being made to a larger catalog for detailed information.

Refrigerating and Ice-Making Machinery.—The Frick Company of Waynesboro, Pa., has issued a 176-page catalog on refrigerating and ice-making machinery that gives necessary information as to the art of modern refrigerating engineering and also complete data on the Frick system. The text is well illustrated and shows care in its make-up.

Consulting-Engineering Service.—Esterline & Angus, consulting engineers, Indianapolis, Ind., have prepared a booklet entitled "An Unique Service by an Unique Organization." This book sets forth the functions performed by this organization, and illustrates its capacity and resourcefulness for the successful solution of difficult problems in engineering design.

Job Press Motors.—The Sprague Electric Works of the General Electric Company, 527-531 West Thirty-fourth Street, New York City, have published Bulletin No. 48707 on direct-current motors and controllers for job presses, folders and book-binding machinery. The text is well illustrated, showing various types of motors and control apparatus, as well as actual installations.

New England

MECHANIC FALLS, ME.—The Oxford Electric Light Company, recently organized, has taken over the properties of the Mechanics Falls Electric Light Company and the Norway & Paris Street Railway Company.

PORTLAND, ME.—The Portland High School Commission has awarded the contract for electrical wiring in the new high school building to L. W. Cleveland & Company of Portland, at $22,000.

CONCORD, N. H.—The Concord Electric Company has petitioned the Public Service Company for permission to take over the property and franchises of the Penacook (N. H.) Electric Light Company, and also to engage in business in the town of Boscawen.

GREAT BARRINGTON, MASS.—The Great Barrington Electric Light Company has awarded the contract for the erection of electric transmission lines to New Marlboro and Southfield (a total of 12 miles) to the F. T. Ley Company of Springfield.

LOWELL, MASS.—The Lowell Electric Light Corporation has applied to the Council for permission to lay underground conduits in Appleton and Garnet Streets.

PETERSHAM, MASS.—The town of Petersham is contemplating the installation of an electric-lighting system. If the proposal is carried through energy will be obtained from the Athol (Mass.) Gas & Electric Company.

THOMPSONVILLE, CONN.—The installation of an ornamental lighting system in the business district is under consideration.

WEST CHESHIRE, CONN.—Plans have been prepared by the Bell & Socket Company for the erection of a new power plant to be located some distance from its factory.

Middle Atlantic

ALBANY, N. Y.—An ordinance has been passed by the City Council authorizing the installation of ornamental lamps in Lakewood Boulevard.

BROOKLYN, N. Y.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Oct. 24 for delivering at the navy yard, Brooklyn, N. Y., blowers, silk cloth and cord, electrical supplies, laundry machinery, etc. Proposal blanks may be obtained at the above office or from the supply officer, navy yard, Brooklyn.

COHOES, N. Y.—The Cohoes Gas Light Company has applied to the Public Service Commission for authority to erect electric transmission lines along the Erie Canal between the cities of Cohoes and Watervliet and the village of Green Island.

DANNEMORA, N. Y.—Bids will be received by James M. Carter, superintendent of prisons, Capital, Albany, until Oct. 18 for engine and generator for the Dannemora (N. Y.) State Hospital. For details see proposal columns.

LANCASTER, N. Y.—The Depew & Lancaster Light, Power & Conduit Company of Lancaster has applied to the Public Service Commission for permission to construct transmission lines in the towns of Clarence and East Hamburg.

LYONS, N. Y.—The local plant of the Niagara, Lockport & Ontario Power Company is being enlarged. The output, it is understood will be increased to 25,000 kw.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities, Municipal Building, New York, N. Y., until Oct. 17 for furnishing material and construction and equipment of an automatic coal railway and trestle at the power house of the Metropolitan Hospital, Blackwells Island. Blank forms and further information may be obtained at the office of the purchasing agent, Tenth Floor, Municipal Building, where plans and specifications may be obtained.

WATERFORD, N. Y.—The Public Service Commission has granted the Troy (N. Y.) Gas Company permission to exercise an extension of an electric-lighting franchise in Waterford.

WEST HAVERSTRAW, N. Y.—Bids will be received by George Blagden president of board of managers, New York State Hospital for the care of Crippled and Deformed Children, West Haverstraw, N. Y., until Oct. 27 for construction, including heating, plumbing and drainage and electric work for the completion of the main building at the New York State Hospital for the care of Crippled and Deformed Children. Drawings and specifications may be obtained at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

BOYERTOWN, PA.—The Boyertown Electric Company, it is reported, will close down the local plant and purchase energy from the Metropolitan Electric Company of Reading. The station in Boyertown will be held for use in emergencies.

CHAMBERSBURG, PA.—The Cumberland Valley Utilities Company recently incorporated, it is reported, will take over and operate Chambersburg, Greencastle & Waynesboro Street Railway Company, the electric railway between Chambersburg and Shippensburg, the Waynesboro gas plant, the Waynesboro electric plant, the properties of Greencastle electric light and Shippensburg gas and electric companies. Options have been closed on these properties by New York City and Baltimore capitalists.

DARBY, PA.—The city of Darby has entered into a contract with the Delaware County Electric Company of Lansdowne to light the streets of the city.

GREENVILLE, PA.—The Mercer County Light, Heat & Power Company of Greenville is erecting a new plant, which will be completed about Jan. 1, 1917. The equipment will include two 500-hp. Erie City Iron Works boilers and one 500-kw. General Electric generator. L. G. Lanning is superintendent.

OIL CITY, PA.—The City Council has awarded the Citizens Light & Power Company a contract for street-lighting for a period of five years. The new contract provides for replacing the 250-cp. arc lamps now in use with nitrogen lamps of 400 cp. and the 60-cp. tungsten lamps with nitrogen lamps of 100 cp. At the expiration of the contract the street lamps and fixtures will become the property of the city.

PHILADELPHIA, PA.—Work will soon begin on the installation of a new City Hall power plant, to cost about $90,000.

PITTSBURGH PA. — The Duquesne Light Company has petitioned the Public Service Commission for approval of lighting contracts with the borough of Rankin and the township of Scott. A contract with the town of Johnsonburg is still pending.

PITTSBURGH, PA.—The Pittsburgh Trolley & Forge Company has engaged W. E. Moore & Company of Pittsurgh, engineers, to rearrange its forge and machine shops for electrical operation, including the installation of an electric plant, individual motor drive, electric welders and other improvements.

WOODBURY, PA.—The establishment of a municipal electric-light plant is under consideration by the City Council.

BAYONNE, N. J.—The City Commission is considering plans for the installation of a street-lighting system along lower Broadway, adjoining the Central Broadway system, now in course of construction, including the installation of an underground conduit.

NUTLEY, N. J.—The Essex County Park Commission contemplates the installation of a new lighting system in Yantacaw Park.

TRENTON, N. J.—The Western Union Telegraph Company has been granted permission by the Council to construct and maintain conduits and underground ways in, under and across streets and alleys of the city.

BALTIMORE, MD.—Contract has been awarded by the Crown Cork & Seal Company, 1501 Guilford Avenue, Baltimore, to the Consolidated Engineering Company, Calvert Building, for the erection of a substantion at Guilford Avenue and Oliver Street.

BALTIMORE, MD.—The Southern Hotel Company, Calvert Building, has awarded contract for construction of hotel at Light and German Streets, to the Longacre Construction Company 11 East Forty-second Street, New York, N. Y. An electric lighting and steam heating plant is included in the contract.

BAY SHORE PARK, MD.—Plans have been prepared by the Bay Shore Park Development Company, Munsey Building, Baltimore, providing for gas and electric service, sewer system, pier, etc. in connection with the development of Chesapeake Bay land for home sites. Bay Shore Park offices are located at Cecil Avenue and Armstead Drive.

LOGAN, W. VA.—The Boone Power Company, recently organized, it is reported, will purchase energy from the Logan County Light & Power Company, to be distributed over existing lines, which it has acquired. M. A. Maxwell, James Jones and others are interested.

OCCOQUAN, VA.—The Commissioners of the District of Columbia are considering an appropriation of $2,000, as recommended in the annual report of W. H. Whittaker, superintendent, for developing water power for work house at Occoquan.

RICHMOND, VA.—A site has been purchased near the city of Richmond by the James River & Kanawha Power Company, on which it proposes to erect a power plant. W. P. De Saussan is manager.

WASHINGTON, D. C.—Bids will be received at the office of the superintendent of the U. S. Coast and Geodetic Survey, 205 New Jersey Avenue S. E., Washington, D. C., until Oct. 24 for furnishing and installing an electric lift. For details see proposal columns.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until Oct. 24, under proposal 865 for furnishing miscellaneous quantity of wire and cable. For further information address Major Charles S. Wallace.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Oct. 17 for one dynamometer, to be delivered at the naval experiment station at Annapolis, Md. Proposals may be obtained at the above office or at the navy pay office, Baltimore, Md.

WASHINGTON, D. C.—Bids will be received at the office of the chief clerk of the Post Office Department, Washington, D. C., until Oct. 25 for furnishing and installing the mechanical equipment, including plumbing, heating apparatus, electric conduit and wiring, interior lighting fixtures, fire-alarm system ash lift and the elevator cars and machinery for the United States Post Office Department equipment shops, to be located at Fifth and W Streets Northeast, Washington, D. C.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington D. C., for furnishing at the various navy yards and naval stations supplies as follows: San Francisco, Cal., Schedule 252—one automobile ambulance. Washington, D. C., Schedule 221—6600 ft. single-conductor, seven sets micrometer calipers; Schedule 225—one 135-ton overhead travelling crane, one turret lathe. Brooklyn, Mare Island, Schedule 251—furnishing and installing miscellaneous refrigerating apparatus. Schedule 250—eight engine room, fire and bilge, pumps. Mare Island, Cal., Schedule 237—6500 ft. flexible plow steel wire rope. Schedule 239—7000 lb. sheet copper. Schedule 238—228 compression grease cups. Eureka, Cal., Schedule 249—one motor truck. Norfolk, Va., Schedule 244—five jib lifting hydraulic cranes. New Orleans, La., Schedule 243—one steam hoisting engine, one steam ram pile hammer. Newport, R. I., Schedule 254—one high-speed, motor-driven saw, ten 14-in. diameter meal slitting saws. Philadelphia, Pa., Schedule 256—one electric spot welder; Schedule 232—miscellaneous sheet copper; Schedule 231—168 soldering coppers; Schedule 227—1000 lb. seamless copper tubing. Brooklyn, N. Y., Schedule 246—two electrically-driven deck winches. Boston, Mass., Schedule 248—one 16-in. automatic tapping machine; Schedule 232—8600 lb. bar copper; Schedule 224—6730 lb. sheet copper. Mare Island, Puget Sound Schedule 240—miscellaneous seamless brass pipe, 1150 lb; seamless copper tubing; Schedule 239—miscellaneous copper bar. Applications for proposal blanks should designate the schedule desired by number.

North Central

HILLSDALE, MICH.—The City Council is contemplating the purchase of a turbine, to cost about $18,000, for the municipal electric-light and water-works plant. The purchase of a chemical engine is also under consideration.

NILES, MICH.—The Board of Electric Light and Water Commissioners expects to purchase a 120 to 150-hp. oil engine for the municipal electric plant. F. S. Hadfield is superintendent.

CELVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, Ohio, until Oct. 20 for non-conduction covering for covering steam pipes. Specifications may be obtained upon application to the office of the division of light and heat, Room 204 City Hall.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland Ohio, until Oct. 18 for underground conduit for electric wire cables for the

filtration plant at Division Avenue pumping station. Specifications may be obtained upon application to the commissioner of water, 211 City Hall.

DUNKIRK, OHIO. — The Council has awarded the Hardin-Wyandot Lighting Company of Kenton a franchise to supply electricity for street-lighting in Dunkirk for a period of ten years.

LOWELLVILLE, OHIO.—The Mahoning & Shenango Railway & Light Company of Youngstown, it is reported, contemplates increasing the output of the Lowellville plant by 20,000 hp., making a total of 60,000 hp.

ST. BERNARD, OHIO—A petition has been circulated asking for an ordinance providing for a bond issue of $90,000 for improvements and extensions of the municipal electric-light plant and waterworks system.

URBANA, OHIO.—Arrangements are being made by the North Western Ohio Light Company of Urbana for the erection of a transmission line to Westfield in the near future, which, it is expected, will eventually be extended to St. Paris. Approval has already been received from the Boston office for the erection of a transmission line to Cable.

YOUNGSTOWN, OHIO.—The City Council has granted the Mahoning County Electric Company a 25-year franchise to supply electricity for lamps and motors in Youngstown, at the rate of 6 cents per kw-hr. for the first ten years. It is expected that the granting of this franchise will result in the erection of a new power plant.

ARLINGTON, KY.—A committee has been appointed to make investigations relative to the installation of an electric-light and water plant in Arlington. A. U. Given is chairman of committee.

GREENVILLE, KY.—At an election to be held Nov. 7 the proposal to issue $100,000 in bonds for the construction of an electric-light plant and water-works system will be submitted to the voters.

MIDDLESBORO, KY.—The power plant and other property of the Monarch Coal Company was recently destroyed by fire. The loss is estimated at $5,000.

BICKNELL, IND.—The plant of the Bicknell Light & Water Company has been purchased by the Indiana Power & Water Company of Bloomfield. The local plant will be dismantled and taken to Edwardsport. 5 miles distant, and a larger plant installed here. The new company will supply electricity to several surrounding towns and is asking for franchises in Edwardsport, Westphalia, Sanborn, Marco, Lyons, Switz City and Bloomfield. A power plant will also be erected in Bloomfield. A transmission line will be erected to Elnora, Odon and Newberry. The company will also take over the Lynn coal mine, owned by the Bicknell company, which will provide coal for the four power stations of the company, which will be in operation in a short time.

BRYANT, IND.—The local electric-light plant, owned by Bowen & Son, was recently destroyed by fire, causing a loss of about $8,000.

ARENZVILLE, ILL.—The Arenzville Light & Power Company, recently incorporated with a capital stock of $10,000, contemplates the construction of an electric-light plant here. John C. Pratt is interested.

HEBRON, ILL.—The L. E. Myers Company, it is reported, is extending its transmission lines to Hebron to furnish electrical service here.

MUNCIE, ILL.—The installation of an electric-lighting system in Muncie is under consideration. Energy will probably be obtained from the municipal electric plant in Fithian.

ASHLAND, WIS.—The Chicago & Northwestern Railroad Company is planning to build a third ore dock of 5000 tons capacity at Ashland, to cost about $2,000,000. The plans provide for a power plant.

HORTONVILLE, WIS.—The Hortonville Heat, Light & Power Company has been granted a franchise to furnish electricity here. The city has contracted with the company for the installation of a street-lighting system, consisting of 25 lamps.

BETHEL, MINN.—A franchise has been granted to the Eastern Minnesota Power Company of Pine City for the installation of an electric-lighting system in Bethel.

GAYLORD, MINN.—The municipal electric plant has been purchased by the Northern States Power Company of Chicago, Ill. The company will extend its transmission line to Gaylord in about six months. F. J. Hecht is superintendent.

HASTINGS, MINN.—The Hastings Electric Light & Water Power Company contemplates improvements to its distribution and transmission lines (mostly rehabilitation work); also to make a number of extensions to lines in and around Hastings, Minn., and Prescott, Wis. H. Pritchard is president.

HEIBERG, MINN.—J. F. Heiberg, owner of the local electric-light plant, contemplates the erection of a transmission line from Heiberg to Gary, a distance of 6½ miles.

HUTCHINSON, MINN.—The Northwest Light & Power Company of Hutchinson is erecting a 13,200-volt transmission line from Plato to Lester Prairie and Winsted, Minn., which will be completed within 60 days. A line is also being built from Hutchinson to Silver Lake, which will be finished soon. When the lines are completed the plant in Hutchinson will supply energy at Biscay, Glencoe, Plato, Young America, Norwood, Lester Prairie, Winsted and Silver Lake. While the line will carry 13,200 volts, it is designed for 33,000 volts. Thomas Pitts is manager.

LAKE PARK, MINN.—Bids will be received by the State Board of Control, State Capitol, St. Paul, until Oct. 20 for the erection of an electric-light plant for the Sand Beach Sanatorium at Lake Park. Specifications may be seen at the office of Rose & Harris, engineers, Auditorium Building, Minneapolis.

MADISON, MINN.—The town of Madison is contemplating the installation of a new pumping unit in the municipal electric plant and is in the market for a water-driven centrifugal pumping outfit, having a capacity of 6000 gal. per hour, complete with pump, motor, three phase, 60 cycles, 220 volts, and storm or float switch. J. C. Bang is superintendent.

MONTEVIDEO, MINN.—The Minnesota Valley Power Company is remodeling its plant at Montevideo and installing a 355-hp. Freeman boiler, equipped with mechanical stokers, one 500-kw. General Electric turbine, General Electric switchboard, three 200-kva., 23,000/2200 volt transformers, electrolitic lightning arresters, etc. The company is also erecting a transmission line between Renville and Olivia, connecting up the companies operated by the Renville County Electric Company of Bird Island. It is also building a transmission line to and a distribution system in Watson. J. W. Campbell, Jr., is manager.

MORGAN, MINN.—The Northern States Power Company has taken over the property of the Wherland Electric Company of Morgan, which supplies electricity in North Redwood, Morton, Morgan, Franklin, Gillfillan and other places in this vicinity. The Northern States Power Company is extending its transmission lines west from Minneapolis and will supply the above towns and a number of other towns in Central Minnesota through its long distance lines.

PARKERS PRAIRIE, MINN. — The Parkers Prairie Electric Company is considering the installation of a 12-hp. gas engine and a 10-kw.. 220-volt, direct-current generator to take care of the night load after 12 o'clock instead of storage battery. The company is also erecting about 1 mile of pole line, for which material has been purchased. L. J. Morrison is manager.

PLAINVIEW, MINN.—The property of the Plainview Electric Light & Power Company has been purchased by the Commonwealth Utilities Company, Mankato. The new owners will make improvements to the property and establish a 24-hour service. Energy to operate the local system will be obtained from the high power dam plant.

ROBBINSDALE, MINN.—The Village Council has decided on the installation of an electric-lighting system and other improvements in the village.

ST. CLOUD, MINN.—The St. Cloud Public Service Company is considering the erection of an electric transmission line from St. Cloud to Buffalo, taking in Clear Lake, Becker, Big Lake and other cities, where it expects to furnish electrical service.

CEDAR RAPIDS.—The Iowa Electric Company has applied to the State Railroad Commission for franchises for the erection of electric transmission lines in Delaware and adjacent counties.

ELKADER, IOWA.—Plans are being considered by Schmidt Brothers & Company of Elkader for extension of their transmission lines from this city to St. Olaf and Farmersburg.

FORT MADISON, IOWA.—The Council is considering plans for the construction of a power house, 34 ft. by 44 ft. H. F. Liebbe, State Capitol Building, Des Moines, is architect.

HUMBOLDT, IOWA.—The Northern Iowa Gas & Electric Company has been granted permission to erect an electric tranmission line in Wright County.

SHENANDOAH, IOWA.—At the general election to be held Nov. 7 the proposal to establish a municipal electric-light plant in Shenandoah will be submitted to the voters.

BARNARD, MO.—The Maryville (Mo.) Electric Light & Power Company has been granted a franchise to supply electricity in Barnard. Work will soon begin on the erection of a transmission line.

BRUNSWICK, MO. — The Brunswick Light & Water Company is erecting a transmission line from Brunswick to Keytesville and Dalton to supply electricity for lamps and motors in those towns. L. A. Nickell is vice-president and manager.

JOPLIN, MO.—Bids will be received by the board of education, Joplin, Mo., until Oct. 26 for construction of a new high school building, to cost about $250,000. Separate bids to be submitted on heating, plumbing and ventilating systems. The plans provide for the use of xduct, galvaduct or sheraduct conduits, 82 switchboards, Western Electric Company's storage battery, Standard or Seth Thomas master and program clocks. Smith, Rea & Lovitt, 602 Finance Building, Kansas City, Mo., are architects.

LIBERTY, MO.—A petition is being circulated asking the city to investigate the question of the purchase of the local electric plant or the installation of a municipal electric plant.

MARSHFIELD, MO.—The Marshfield Electric Company is contemplating the installation of a 50-hp. oil engine. As yet nothing definite has been decided upon.

MONTGOMERY CITY, MO.—The Montgomery Ice & Electric Company contemplates the construction of a large storage house (100 tons capacity) for ice. E. H. Algermissen is proprietor.

ST. LOUIS, MO.—The Emil Sieloff Provision Company is considering the construction of a cold storage plant. Electricity will be used to operate cooling system.

ST. LOUIS, MO.—The Cupples Station Light, Heat & Power Company of St. Louis has applied to the Board of Public Service for a franchise to lay a lateral to conduit to connect two of its plants in the downtown district.

ST. LOUIS, MO.—The J. C. C. Waldeck Electric Railway Company has submitted to the Board of Public Service an application to construct and operate an electric railway over Montrose Avenue, from Missouri Pacific tracts to the plant of the Independent Packing Company at Hickory Street and Ewing Avenue.

SLATER, MO.—The purchase of a 72-in. by 18 ft. (150 lb. pressure) fire tube boiler for the municipal electric-light plant is under consideration. L. E. Shepherd is superintendent.

WOONSOCKET, S. D.—Bids will be received by the City Council, Woonsocket, until Oct. 16 for furnishing and erecting a pumping unit, consisting of one Underwriter's standard centrifugal fire pump of 500 gal. per minute capacity, directly connected to a 30-hp., 60-cycle, three-phase, 2300-volt motor. Specifications may be obtained from Sullivan & Putnam, Huron, S. D.

ANSELMO, NEB.—The Anselmo Electric Light & Power Company contemplates the purchase of meters, poles and wire. David Christen is general manager.

ARLINGTON, NEB.—Orders have been placed by the Arlington Light, Heat & Power Company for a boiler feed pump and vacuum pump, both belt driven. The company is considering the installation of an ash and coal conveying apparatus. M. E. Winset is manager.

ATKINSON, NEB.—J. Skrdla & Sons, owner of the local electric-light plant, have recently purchased a 5-kw. exciter and would like to purchase a good second-hand water wheel governor.

BANCROFT, NEB. — Bonds to the amount of $12,000 have been issued for the installation of an electric-lighting system.

BERTRAND, NEB.—At an election to be held Oct. 17 the proposal to issue $11,000 in bonds for the installation of an electric-light plant will be submitted to the voters.

EXETER, NEB.—The property of the Exeter Light & Power Company has recently been taken over by the Continental Gas & Electric Company of Cleveland, Ohio, and will probably be connected with its transmission lines next summer.

FAIRBURY, NEB.—The Water, Light and Sewer Commission is considering the purchase of a new 300 to 400-hp. generating unit, consisting of a generator directly connected to engine or turbine, for the municipal electric-light plant next year; also transformers, from 3 to 10 kw., probably about 10 in number. G. D. Myers is manager and engineer.

NORFOLK, NEB.—The Nebraska Gas & Electric Company contemplates extending its electric transmission line from Tilden to Oakdale, a distance of 10 miles. W. G. Ross, 505 Karbach Building, Omaha, is general manager.

STERLING, NEB.—Preliminary surveys have been completed by the Sterling Light

& Power Company for the erection of 50 miles of three-phase, 13,200-volt transmission line. W. W. Marks is general manager.

FORD, KAN.—Work has begun on the erection of an electric distribution system in Ford. Energy will be secured from an electric transmission line which passes through the town.

HAYS, KAN.—The City Council is considering the purchase of the plant of the Hays Electric Light Company, to be owned and operated by the municipality. If taken over by the city improvements will be made to the system.

LENORA, KAN.—An election will be held Oct. 26 to submit to the voters the proposal to issue $10,000 in bonds for an electric lighting plant and city hall building.

MINNEOLA, KAN.—The contract for the installation of a municipal electric-lighting system is reported to have been awarded to the I. C. Bushong Company of Ottawa, at $15,877. H. W. Magruder of Liberal is engineer.

SPRING HILL, KAN.—An election will soon be held to submit to the voters the proposal to issue $4,000 in bonds for the installation of an electric-lighting system.

Southern States

MADISON, N. C.—Bonds have been authorized for the construction of an electric-light and power plant, to cost from $7,000 to $8,000.

MOCKSVILLE, N. C.—The City Council is considering calling an election to submit to the voters the proposal to issue bonds for the installation of an electric-lighting system and waterworks.

PILOT MOUNTAIN, N. C.—The Pilot Electric Company has been granted a franchise to construct and operate an electric-lighting system in Pilot Mountain for a period of 20 years. Job Hiatt and others are interested in the company.

PAMPLICO, S. C.—The contract for installing an electric-lighting plant in the mill of the Dargon Wagoner Company has been awarded to L. H. White, at $1,500.

DAWSONVILLE, GA.—The installation of an electric-lighting system in Dawsonville is under consideration. Howser Brothers are reported interested.

MOORE HAVEN, FLA. — The South Florida Farms Company is building a combination electric and ice plant at Moore Haven. The equipment will consist of one 30-kw. and one 75-kw., three-phase, 2300-volt generator and a 25-ton ice machine, driven by Diesel engines. L. J. Schwingel of Moore Haven has change of construction of plant.

KNOXVILLE, TENN.—Steps have been taken by the Vine Street Business Men's Club for the installation of an ornamental street-lighting system in that section of the city.

MARVEL, ALA.—The Roden Coal Company of Marvel would like to receive prices and full particulars on a 150 to 200-kw., three-phase, 60-cycle, 2300-volt generator (belted) with exciter.

TALLADEGA, ALA. — The Alabama Power Company, it is reported, contemplates the erection of an electric transmission line from its substation at Ashland to the mining plant of the Lineville Graphite Company.

DURANT, MISS.—Plans are being considered for improvement to the municipal electric-light plant, including replacing the steam engine (belt driven) with a crude oil engine, directly connected, and changing the system from single to three phase. E. W. Weathers is superintendent.

DEWITT, ARK.—The village of DeWitt has granted the Stuttgart (Ark.) Public Service Company a franchise to construct and operate an electric-light plant and waterworks system here.

PINE BLUFF, ARK.—The capital stock of the Pine Bluff Company has been increased from $1,200,000 to $2,000 000, the proceeds to be used for future extensions and improvements to electric-light waterworks and street railway systems.

LAFAYETTE, LA.—An appropriation of $20,000 has been made by the City Council for the installation of an oil engine and generating apparatus at the municipal waterworks plant.

KEY WEST, FLA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 28 for radio station, consisting of two wood-frame buildings, three guyed pipe masts, sewer, water and lighting systems, at the distant control naval radio station, Key West, Fla. Plans and specifications may be obtained on application to the Bureau of Yards and Docks, or to the commandant of the naval yard named.

ARDMORE, OKLA.—The City Council has approved plans for the installation of an ornamental lighting system which will soon be submitted to the voters. It is proposed to grant a franchise for a period of 25 years to supply electricity to maintain the system.

MARLOW OKLA.—Extensive improvements are contemplated to the municipal electric-light plant and waterworks system, including the construction of power house, installation of engine, generator and motor, pumps, etc. The cost of the work is estimated at $50,000.

SKIATOOK, OKLA.—The installation of a municipal electric-light plant and waterworks system in Skiatook is under consideration.

BURNET, TEX.—W. C. Galloway of Burnet, it is reported, contemplates the installation of an electric-light plant here.

JACKSONVILLE, TEX.—The Jacksonville Electric & Ice Company, recently incorporated with a capital stock of $90,000, proposes to construct and operate an electric-light plant and ice factory here. R. W. Baker of Palestine, Tex., is interested.

SAN ANTONIO, TEX.—The Alamo Iron Works is contemplating the use of electrically operated machinery throughout its entire plant, with the possibility of installing an electric generating plant of from 300 to 500 hp. A good portion of the plant is now operating by electricity. For further information address Frank E. Scovill.

SAN BENITO, TEX.—A committee has been appointed by the City Commission to investigate the feasibility of the city acquiring an electric-light and water-works plant, to be owned and operated by the city.

SHERMAN, TEX.—Bonds to the amount of $10,000 have been voted for the installation of an ornamental street-lighting system.

STAMFORD, TEX.—The Stamford Gas & Electric Company is planning to extend its street-lighting service here.

Pacific States

CHEWELAH, WASH. — Arrangements are being made by the City Council for the installation of a new street-lighting system in Chewelah.

EVERETT, WASH.—Plans are being considered by J. F. Klein and associates for the construction of a power plant on the Boulder River, located in the southern section of Snohomish County. Notices of water rights have been filed and, it is understood, that active construction will soon begin. Water flow is estimated at 1000 ft. per second.

NORTH YAKIMA, WASH.—The Pacific Power & Light Company has notified the Yakima County Commissioners that it will refuse the 25-year franchise granted recently by the Commissioners for the erection of a pole line extension along the highways, near Sunnyside, to supply electricity to farmers in that section. The company insists on a 50-year franchise.

SEATTLE, WASH.—C. E. Dole, purchasing agent of the Alaskan Engineering Commission, Bell Street Dock, Seattle, will receive bids until Oct. 25 for an electric traveling shop crane and switch points.

SPOKANE, WASH.—An agreement has been reached between the City Council and the Tacoma Railway & Power Company, whereby the company will secure energy from municipal electric plant on Nisqually River during the low water periods on the Snoqualmie River.

BANDON, ORE.—Two propositions, it is reported, have been submitted to the Bandon Light & Power Company by the Oregon Power Company for the purchase of its plant. One is that the Oregon company supply electricity to operate the Bandon system and the other that the Bandon Light & Power Company sell its plant and distributing system to the Oregon company. If the Bandon plant is taken over the Oregon company plans an expenditure of from $90,000 to $100,000, and an additional $50,000 to $60,000 to double the output of the Marshfield plant. If the transmission line is extended to Bandon it will also serve Parkersburg, Lampa, Prosper and all ranches on the line.

MYRTLE CREEK, ORE.—Application has been made by the town of Myrtle Creek to the State Engineer to appropriate 150 second ft. of water from the South Umpqua River to develop power for a municipal electric plant. A dam 27 ft. high will be built. The cost of the proposed plant is estimated at $30,000.

NORTH PLAINS, ORE.—The Town Council, it is reported, is negotiating with a power company to establish electrical service for street and residential lighting in North Plains.

PORTLAND, ORE.—The contract for the construction of power house for the Sisterhood of Good Shepherd has been awarded to Litherland & Abrey of Portland. The building will be 86 ft. by 112 ft.

BAKERSFIELD, CAL.—The Southern Sierras Power Company, we are informed, does not contemplate the erection of a pole line in the neighborhood of Bakersfield. An item in the issue of Sept. 25 stated that the company has applied for a 50-year franchise to erect transmission lines in Kern County.

FORT BIDWELL, CAL.—The Bidwell Electric Company, recently organized, is planning to supply electricity for lamps and motors in Bidwell East, Bidwell West and Lake County precincts of Modoc County.

REDDING, CAL.—The Northern California Power Company of San Francisco has purchased the ranch of T. H. Benton on Battle Creek, which carries with it three important water rights from Digger Creek, Bailey Creek and Battle Creek.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company is planning to erect an electric transmission line to the Pacific property, located in the American Fork district. The company will probably supply energy to other mines in that section.

DOUGLAS, ARIZ.—The City Council is considering the installation of an ornamental street-lighting system. George N. Wood is city engineer.

TEMPE, ARIZ.—The City Council is considering the installation of a municipal electric-light plant, to cost about $26,000.

BAKER, MONT.—The Baker Light & Power Company contemplates the purchase of a 72-in. by 16-ft. boiler for 125 lb. pressure, one 150-kw., three-phase, 60-cycle, 2300-volt generator, 50-kva. in distributing transformers, cooling tower for 125-kva. generator, one feed pump, 50 miscellaneous meters, 50 hp. in small motors, car poles, 10,000 ft. No. 6 weather-proof wire 2000 ft. No. 8 weather-proof wire, 100 flat irons and five electric ranges. Ernest G. Heinrich is proprietor.

MOORE, MONT.—The Montana Power Company, it is reported, is planning to rebuild its local system next spring. J. David is local manager.

RED LODGE, MONT.—The Northwestern Improvement Company of Red Lodge contemplates changing its street-lighting system from arc to incandescent lamps. Thomas Murphy is master mechanic.

ROUNDUP, MONT.—Bids will be received by the city of Roundup until Oct. 17 for installing street lamps in special lighting improvement district No. 15. The plans provide for 2120 lamps, 27,500 ft. simplex park and suburban cable. Claude A. Renshaw is city engineer.

YUMA, COL.—The town of Yuma expects to enlarge the municipal electric-light plant in the near future and is in the market for a 75-hp. engine and generator. William Sydow is superintendent.

Canada

GRAND FORK, B. C.—The City Council is considering extensions to the municipal electric-light plant.

NELSON, B. C.—The directors of the Utica mine, it is reported, contemplates the construction of a power plant to supply electricity to operate the mine and mill.

GALT, ONT.—The town of Galt has decided to double the capacity of the transmission line of the Hydroelectric Power Commission, increasing it from 6600 to 13,200 volts. This will require an enlargement of the substation and additions to plant.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Oct. 25 for suction pipe and fittings, sheet copper, copper tubing, sheet brass, bronze, bars, sheet tin, banca tin, sheet lead, solder, wire, electric cable, electrical attachments, telephone supplies, wire molding, cable clips, cable thimbles, anchor lights, etc. Blanks and general information relating to this circular (No. 1089) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

1,199,750. Electrical Protective Device; B. S. Aikman, Milwaukee, Wis. App. filed Dec. 24, 1914. Preventing burn-outs of electric motor winding, depending for operation upon temperature of winding.

1,199,783. Lockout for Party Lines or Extension Telephones; O. D. M. Guthe, East Orange, N. J. App. filed May 13, 1915. Affording clear circuit to central office free from interruptions, particularly applicable to automatic telephone systems.

1,199,788. Telephone Exchange System; E. E. Hinrichsen, New York, N. Y. App. filed May 24, 1915. Central energy type in which it is impossible to apply ringing current to busy line.

1,199,789. Electrical Conductor; M. Hochstader, Harrisburg, Pa. App. filed March 27, 1913. For high tension underground cable; free of internal sparking and glowing.

1,199,792. Electropneumatic Organ Valve; R. Hope-Jones, Deceased, North Tonawanda, N. Y. App. filed Nov. 14, 1914. Simplified construction and greater accuracy obtained in operation.

1,199 797. Conduit for Passenger Car Electrical Wiring; J. G. Lawler, St. Charles, Mo. App. filed Feb. 10, 1913. Main line and circuit wire conduits between inner and outer roof sheets virtually becoming part of framework.

1,199,829. Battery Meter; W. M. Scott and R. E. Tresise, Cleveland, Ohio. App. filed Nov. 6, 1914. Permanent magnet type embodying novel features of construction conducive to economy of production and compactness of construction.

1,199 831. Switch Operating Mechanism; C. W. Squires, Beverly, Mass. App. led Feb. 4, 1914. Adapted to be struck by trolley carried by car, closing circuit for sufficiently long time to insure the throwing of the track switch.

1,199,843. Circuit Closer; R. A. Washburn, Mason City, Iowa. App. filed Nov. 22, 1915. For automobile signaling system, affording visual and audible warnings of stopping, turning, etc.

1,199,846. Storage Battrery Case; G Wheat, Philadelphia, Pa. App. filed Nov. 23, 1915. Improved top or cap providing means for connecting wire-containing cord, permitting free movement without danger of breaking cord.

1,199 852. Electric Circuit Controlling Device; A. C. Wyman, Newton, Mass. App. filed Feb. 11, 1915. Capable of being operated by energy developed in solids by jar, shocks, etc., as for example, movement of heavy body, as a train.

1,199,866. Automatic Electric Train-Line Coupling; T. R. Brown, Sparkill, N. Y. App. filed March 31, 1914. Operation of moving parts determined by spring action, operating automatically upon coming together of counter parts.

1,199,867. Automobile-Tail-Light Indicator; W. C. Brown, Fostoria, Ohio. App. filed July 29, 1910. Shows whether taillight is burning.

1,199,916. Device for Operating Electrostatic High-Voltage-Current Generators; E. A. P. Oppen, Cologne-Deutz, Germany. App. filed Sept. 16, 1915. Provides for heating of air in casing of machine without special heating device.

1,199,921. Lifting-Magnet; G. H. Poth, Cincinnati, Ohio. App. filed July 25, 1913. Armature movement performs work, as for instance, operating brakes, switches, etc., and specially designed for long stroke.

1,199,923. Controlling Mechanism for Electric Vehicles; F. E. Queeney, New York, N. Y. App. filed Nov. 30, 1914. Providing interlock between controller, cut-out switch and braking mechanism.

1,199,934. Tone-Producing Means; M. L. Severy, Arlington Heights, Mass. App. filed Feb. 20, 1910. Of any desired timbre by utilizing electric current interruptions or alterations.

1,199,936. Overload Protective Device; A. Simon, Milwaukee, Wis. App. filed Dec. 26, 1913. Responsive at one current value upon initial closure, and another current value after temporary period.

1,199,947. Magnetic Chuck; O. S. Walker & I. F. Williams, Worcester, Mass. App. filed March 30 1914. Provided with circular holding face adapted to carry iron and steel pieces operated on. Chuck revolves.

1,199,972. Pole-Arm; C. G. Ette, St. Louis, Mo. App. filed March 1, 1915. For supporting insulators above, below and laterally displaced from the pole top; single cast metal member with plurality of portions.

Record of Electrical Patents

Notes on United States Patents issued Oct. 3, 1916, prepared by Mitchell & Allyn, 41 Park Row, New York.

1,199,975. Solenoid; B. E. Fernow, Milwaukee, Wis. App. filed April 18, 1914. Renders wear on the parts or sticking of plunger negligible.

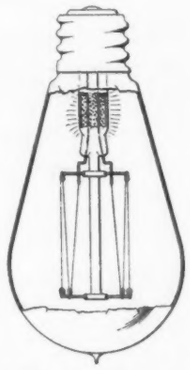
1,199,985. Circuit-Controller; A. J. Horton, White Plains, N. Y. App. filed Oct. 16, 1911. Plurality of switches interlocked in such a manner that one or the other of the switches is always locked in predetermined position when others moved to predetermined position.

,199,990. Track Instrumfnt; J. N. Johnson, Albuquerque, N. M. App. filed May 20, 1914. For automatically indicating to train despatcher's office the respective positions of a number of trains along trackway.

1,199,991. Electric Snap-Switch; O. E. Kenney, Toledo, Ohio. App. filed June 30, 1916. Of key controlled type in which cam member is rotated. Simplified cam construction effecting saving in material and manufacture.

1,199,992. Electric Snap-Switch; O. E. Kenney, Toledo, Ohio. App. filed June 30, 1916. Key-controlled type with rotating cam. Simplified cam construction.

1,200,004. Telegraph-Key; M. H. Meeker, Council Bluffs, Iowa. App. filed Sept. 25. 1913. Providing adjustable cushioned contact point for relieving jar when key is depressed.



No. 1,200,040—Electric Lamp

1,200,017. Induction-Coil and Related Parts; G. Parker, Foxboro, Mass. App. filed Feb. 9, 1914. For use with plurality of operating current sources, securing better balance between condenser capacity, operating current and co-opearting parts.

1,200,025. Process of Recovering Metal; C. J. Reed, Glenside. Pa. App. filed Aug. 25, 1915. From ores and other material by electrochemical operations on aqueous solutions containing metals.

1,200,038. Signaling Mechanism; F. O. Singer, Chicago, Ill. App. filed Dec. 22, 1915. For selecting signals and for controlling electric circuit in accordance with selected signal.

1,200,040. Electric Lamp; J. B. Speed, West New Brighton, N. Y. App. filed Feb. 23, 1915. Gives off light for considerable period of time after lamp is extinguished. Light given off stored while lamp was burning.

1,200,063. Electric Condenser; E. B. Wheeler & M. Sultzer, East Orange, N. J. App. filed Jan. 15, 1916. Constructed to be capable of a high degree of capacity adjustment during manufacture.

1,200,074. Combination Electric Switch; O. H. Bloomquist, Crooks, Iowa. App. filed Jan. 13, 1914. Connected in different series, indicating characters, adjacent switches enabling operator to complete circuit by secret combination, capable of large variations.

1,200,081. Telephone Exchange System; H. P. Clausen, Mount Vernon, N. Y. App. led March 15, 1915. Improved signaling means for system of central energy type.

1,200,082. Telephone Transmission System; E. H. Colpitts, East Orange, N. J. App. filed Dec. 27, 1915. To increase amplification at which a telephone repeater may operate with stability under practically loaded line condition.

1,200,095. Selectively Operated Circuit Controlling Device; J. C. Field, Orange, N. J. App. filed March 26, 1915. Selectively operated step by step device operating efficiently in response to alternating current impulse.

1,200,105. Electrically Operated Type Writer; E. Hausberg, Charles City, Iowa. App. filed July 25, 1912. Electromagnetic means for operatively connecting any one of the series of type bar operating levers to a universal operating bar.

1,200 122. Method and Apparatus for Eliminating Moisture from Evacuated Spaces; A. J. Liebmann, New York, N. Y. App. filed May 17, 1915. Great difference of temperature created between space to be exhausted and free from moisture and the space in which drying substance is preferably kept.

1,200,153. Circuit Controller for Smoke and Fire Detecting Devices; J. Warshawsky, A. Rodack and A. Rodack, Jersey City, N. J. App. filed Nov. 2 1914. Means for detecting smoke or like hot gases to actuate fire fighting device such as alarm gong or switch.

1,200,156. Telephone Exchange System; J. L. Wright, Cleveland, Ohio. App. filed July 10, 1915. Switches and controlled devices co-operate to insure positive and accurate stopping of the switches.

1,200,165. Method and Apparatus for Sterilizing; C. F. Burgess, Madison, Wis. App. filed Oct. 30, 1913. Treatment of liquids by electrolytic action as typified by purification of water for drinking purposes.

1,200,168. Pull Chain Guide for Electrical Sockets; F. H. Chapman and O. E. Kenney, Toledo, Ohio. App. filed Dec. 10, 1915. Improved means for attaching chained guides to pull sockets.

1,200,183. Dental Vulcanizer; G. B. Fraley, Liberty. N. Y. App. filed Dec. 15, 1915. Electric heating elements and connections disposed to be readily withdrawn.

1,200,210. Transmitter for Etheric or Wireless Telephone Systems; F. H. Millener, Omaha, Neb. App. filed Nov. 7, 1912. The purpose sought is to impress upon the transmitting medium sharp, clear impulses insuring corresponding production at receiving station.

1,200,213. Electric Supply and Control System; J. L. Milton Anderson, Ind. App. filed May 15. 1914. Used in connection with gas engines for ignition of same and operation of lights.

1,200,233. Electrical Apparatus; J. S. Preston, Schenectady, N. Y. App. filed Dec. 30, 1914. Relates to a number of types of electrical apparatus likely to be damaged through resonating with abnormal frequencies.

1,200,257. Arc Lamp; C. P. Steinmetz, Schenectady, N. Y. App. filed Oct. 3, 1912. Improved method of and apparatus for operating arc lamps on alternating current system.

1,200,258. Arc Lamp; C. P. Steinmetz, Schenectady, N. Y. App. filed Jan. 13, 1913. Method and apparatus for operating arc lamps on alternating-current system in which electrodes used give flaming or luminous arc.

1,200,264. Electrically Operated Hoist; F. L. Stone, Schenectady, N. Y. App. filed Sept. 14, 1914. To prevent overwinding.

1,200,267. Lock for Automatic Hoods; A. P. Sunnergren, Wilkinsburg Pa. App. filed Feb. 4, 1915. Electrically controlled.

1,200,277. Automatic Switching Operator's Telephone; R. I. Utter, Chicago, Ill. App. filed Oct. 1, 1913. Connecting card circuits with another operator's telephone when use is discontinued.

1,200,294. Insulator; W. G. Ayre and F. L. Shaw, Baker and Durkee Oregon. App. filed Jan. 9, 1914. Self locking and tieless design.

1,200,310. Motor Control System; F. E. Case, Schenectady, N. Y. App. filed Nov. 21, 1914. Means for starting and accelerating, dependent upon predetermined current values.